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HEMORRHAGIC PNEUMONITIS*†

ROENTGEN RAY STUDIES DURING THE RECENT INFLUENZA EPIDEMIC AT THE WALTER REED GENERAL HOSPITAL, TAKOMA PARK, D. C., BEGINNING OCTOBER 1, 1918

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DEFINITION.—An acute localized toxic inflammation of the cells lining the alveoli, bronchioles, and their capillaries, producing a frank pernicious hemorrhage into the air passages.

Etiology.—It is undetermined what rôle, if any, the influenza bacillus plays in the production of the specific toxin that destroys the integrity of the cells lining the alveoli and bronchioles; but there is strong presumptive evidence to support the theory that the particular toxin which would seem to have a selective action upon these cells is produced locally by organisms which proliferate within air passages in the immediate vicinity of the lesions. This conception of the process is not offered to apply to any other lesion than hemorrhagic pneumonitis.

Occurrence.—The pathological literature on influenza epidemics antedating the present is said to contain no authentic description which conforms to the gross or microscopic appearance exhibited by these lungs, and similarly, no roentgen ray appearances such as we have observed have been described.

Hemorrhagic pneumonitis was recognized by the method of serial daily roentgenographs with the standard U. S. A. bedside roentgen ray machine, and was found to be present, to a varying extent in 386 of the 470 patients referred. All of these, in one form or another, presented clinical evidence of pulmonary complication. The series included 3400 films. Observation on this condition, which we have called hemorrhagic pneumonitis and which we have learned to recognize as a definite roentgenographic entity, was subsequently confirmed by autopsy protocols.

Judging from the descriptions of the autopsy findings on these influenza cases that have come to our attention during the last few months, it seems that pulmonary hemorrhage is a conspicuous factor during this epidemic in all parts of the country. However, the degree of hemorrhagic involvement and also the percentage of hemorrhagic pneumonitis, as compared with streptococcic pneumonia and other variously described pneumonias, have varied considerably in different localities.

Pathology.—The microscopic findings

* Read at the Midwinter Meeting of Roentgenologists, Atlantic City, N. J., January 25, 1919

† Authority to publish granted by the Board of Publication, Surgeon General's Office, Washington, D. C.

have been variously described, some observers laying emphasis upon confluent bronchopneumonia, others describing bronchiolitis associated with more or less hemorrhage.

Captain M. W. Lyon, pathologist to the Walter Reed General Hospital, describes the typical lung appearance as follows:

"The external appearance of a freshly removed lung presents a slaty purple color. It feels firm and airless. Along the lower and anterior edges where there are air-containing and emphysematous lobules there is a sharp line of demarcation between the slaty portion and the air-containing portion, which is pinkish gray. In some cases there may be found air-containing islands in the slaty purple solid portions. In lungs which are incompletely involved, there may be found slaty purple islands in the midst of a pinkish gray field. Beneath the pleura, over the solidified portion, in many places, there are seen red hemorrhagic spots varying in size from less than a millimeter up to 3 millimeters in diameter. These spots have a tendency to coalesce and form large red areas.

"On sectioning the lung, using a sharp knife, without exerting any pressure upon the lung, the cut sections drip great quantities of blood. The cut surfaces do not appear mottled, but are homogeneous, without roughened areas or nodules. The general appearance strongly resembles a large fresh clot of blood."

We encountered a number of cases where several lobes would show a hemorrhagic pneumonitis, while another lobe presented a typical gray hepatization. The recognition of lobar pneumonia associated with hemorrhagic pneumonitis was possible in several cases by means of serial roentgen ray films made prior to death.

Other coexisting intrathoracic complications were encountered in order of frequency as follows:

1. Interlobar pleuritis.
2. Pleurisy with effusion.
3. Mediastinal adenitis.
4. Cardiac enlargement.
5. Empyema.
6. Pericardial effusion.
7. Lobar pneumonia.
8. Diffuse mottling.
9. Plastic exudate.
10. Mediastinal empyema.

Mode of Onset.—Hemorrhagic pneumonitis usually began coincidently with, or soon after, the incidence of a secondary rise in temperature,* occurring from one to five days after the patient had run what was apparently a typical influenza course. Less frequently it appeared on the fourth or fifth day after the initial onset of influenza, where the temperature curve was atypical, in that the characteristic fall did not occur. In a few instances, it was detected the day after the patient went to bed.

Characteristic Roentgen Ray Appearance.—In the earliest stage demonstrable by the roentgenogram hemorrhagic pneumonitis is recognized as a faint filmy haze opposite the level of the lower angle of the scapula. The mesial portion of haze is partially obscured by the outer portion of the normal hilum shadow. This hazy area enlarges in all directions and frequently it is observed that the adjacent portions of the upper and lower lobe are involved simultaneously. The process may advance so rapidly as to include the greater portion of all lobes in the same side of the chest within forty-eight hours. In fulminating cases, all five lobes may become blood-logged and death ensue within forty-eight hours. Hemorrhagic pneumonitis invariably began as a unilateral process, and in 82 per cent of our cases the left lung was primarily involved. It was never seen to begin in any peripheral portion of a lobe, but invariably appeared in the region of the lung roots. It was also noted that the involvement never began simultaneously in two or more widely separated areas, but it was found to spread from the original site.

*This observation was noted early in the epidemic by Lieut. J. Harkavy and personally communicated to me. This enabled us to detect a larger number of early cases than otherwise would have been possible.

Later it may develop around the roots of a lobe on the opposite side. The peripheral portions were the last to fill with blood. The true apex and the lower borders of the lower lobes were never involved. We discovered this characteristic absence of apical costophrenic involvement early in the epidemic and requested a check by autopsy. The autopsy confirmed this, so that we were enabled to utilize the sign in detecting pleuritic involvement. In other words, we found that in every case where the roentgenogram showed a haziness or a total density over the apex or costophrenic angle, it was indicative of a pleuritic complication or lobar pneumonia. In the vast majority of cases we found pleural effusion responsible.

Course.—The hemorrhage showed a tendency to disappear within three days where the area of involvement did not reach a greater diameter than a silver dollar. In moderately advanced cases, e.g., where the invasion was arrested when the involvement included no more than the lower proximal half of the upper left lobe and the adjacent proximal portion of the lower left lobe, the condition would slowly but progressively fade away, usually disappearing by the twelfth day unless complicated by some other intrathoracic condition. If in such a case there had been a progressive clearing demonstrated over a period of several days followed by an interruption, a complication usually appeared soon thereafter, the most frequent one being a pleural effusion. This often changed into empyema.

During the height of the epidemic the cases which showed extensive involvement of all five lobes usually proved fatal regardless of whether the involvement developed slowly or rapidly. Later in the epidemic, the virulence diminished and the percentage of fatalities in extensive involvements became conspicuously less. In some cases the process of absorption of the hemorrhage was noted in one lobe while a complication would develop in the region of another lobe.

Prognosis.—Soon after these daily roentgen ray observations were instituted it was found that the cases presented certain definite characteristics by which a prognosis could be offered with much accuracy. The second or third film usually sufficed to base our predictions on. Our prognosis was made utterly regardless of the clinical data. We based it upon the rate, direction and extent of the spread, interpreted in the experience furnished by the earlier cases.

The rapidity with which the hemorrhage spread to include the lobes opposite the original hemorrhage bore a direct relation to the gravity of the case. We did not observe a fatal case in which the hemorrhage remained a unilateral condition, even though all lobes on the affected side became extensively involved.

Ordinarily if the patient survived seven days after the onset of the hemorrhagic pneumonitis, the prognosis was favorable. However, the convalescence in many cases was interrupted by one or more of the previously enumerated intrathoracic complications. Empyema was the most frequent to occur after the seventh day in hemorrhagic pneumonitis.

In our series, where the roentgen ray observations were possible early in the course of the disease, we erred in two cases where a grave prognosis had been rendered. In one, all five lobes were involved and a bilateral empyema developed subsequently. This case was interesting in that an entirely different organism was recovered from the right pleura than from the left. In the other case, the convalescence was complicated and prolonged.

Theory of Invasion.—The serial radiographic studies upon the trachea, bronchi, bronchioles, alveoli and their capillaries, interpreted in the light of the autopsy findings, support the conception that the causative organism, whatever it be, gains access through the respiratory tract. It lodges and proliferates in the lower portion of the trachea or in a main bronchus, whence the organisms are distributed by contiguity, reaching first the bronchi and

alveoli in the immediate vicinity. These individual colonies elaborate the toxin which produces local destructive change in the cells lining the bronchi, the alveoli, and also the capillary walls, the result being a frank pernicious hemorrhage. The spread is perhaps augmented by the flow or inhalation of the infected bloody exudate into other portions of the respiratory tract. The process seems to develop by spread in contiguity from the original focus in the main bronchus to the alveoli.

The serial radiographs proved that the hemorrhage invariably commenced in the central portion of a lobe nearest the hilum. Later it spread in all directions simultaneously. It is plausible to assume that when the hemorrhage becomes extensive enough all approaches to the peripheral portions of the lobe are likely to be blocked off by the presence of the rapidly accumulated blood in the distributing bronchi. If this is true, the air circulation is retarded and the organisms cannot be transported either by air or by the flow of exuded blood into the more distant alveoli. Autopsy consistently confirmed the conspicuous absence of hemorrhagic pneumonitis in the true apex and in the costophrenic borders of the lower lobes. It was also noted that the alveoli situated nearest the pleura are relatively free from hemorrhage.

This absence of hemorrhage at the apex and in the costophrenic borders, together with the delayed involvement of the peripheral portions of the lobes, strengthens the theory that the hemorrhage is due to the toxins elaborated locally. It is also obvious that the hemorrhage cannot be explained on the assumption of a state of hypostatic congestion because the autopsy findings failed to confirm hypostasis in the most dependent portions of the lower lobes. Thus it is obvious that the condition is in no way a septicemia.

We found it advisable to divide our 470 cases into the following groups:

(*a*) Hemorrhagic pneumonitis uncomplicated. These presented the typical hazy spreading shadow produced by the increased condensation. No discrete mottling was present, nor was there any conspicuous enlargement of the mediastinal glands. No pleuritic complications were present.

(*b*) Hemorrhagic pneumonitis associated with a conspicuous enlargement of the mediastinal glands, but without discrete mottling.

(*c*) Hemorrhagic pneumonitis associated with discrete mottling, but without conspicuous enlargement of the mediastinal glands.

(*d*) Hemorrhagic pneumonitis associated with conspicuous enlargement of the mediastinal glands and with a definite discrete mottling over the pulmonary area.

(*e*) Hemorrhagic pneumonitis complicated by some form of pleural involvement, pericardial involvement and mediastinal empyema.

(*f*) Adenitis unassociated with hemorrhagic pneumonitis, discrete mottling, or any other form of pulmonary or pleural pathology discernible by roentgen ray.

(*g*) Adenitis and fibrosis unassociated with other intrathoracic pathology discernible by roentgen ray.

(*h*) Adenitis without hemorrhagic pneumonitis or discrete mottling but associated with some other intrathoracic pathology.

(*i*) Discrete mottling of the pulmonary area uncomplicated by hemorrhagic pneumonitis, enlargement of the mediastinal glands, or any other intrathoracic pathology discernible by roentgen ray.

(*j*) Discrete mottling associated with conspicuous enlargement of the mediastinal glands unassociated with any other intrathoracic pathology discernible by roentgen ray.

(*k*) Mottling unassociated with hemorrhagic pneumonitis and enlargement of the mediastinal glands, but associated with some other intrathoracic pathology.

(*l*) Hemorrhagic pneumonitis associated with pulmonary tuberculosis.

(*m*) Hemorrhagic pneumonitis associated with lobar pneumonia.

(*n*) Lobar pneumonia uncomplicated by hemorrhagic pneumonitis.

(*o*) Cases in which there was definite clinical evidence of pulmonary pathology but in which the serial roentgenographs failed to confirm the presence of a pulmonary lesion.

Roentgen Ray No. 5622. Group (*e*). Case illustrating hemorrhagic pneumonitis of all lobes associated with pleural effusion (bilateral). This was one of the early cases which formed the basis for the investigation.

FIG. 1. Made in autopsy room. Note homogeneous density in all 3 lobes on right and both on left. Note relative clearness of both apices. The costophrenic angles are obscured by what proved to be fluid. Compare this with Fig. 2 made of thoracic viscera after removal in toto

FIG. 2. The true apices are clear. The costophrenic portions of the lower lobes are relatively clear. All five lobes present a homogeneous density, which is not of such a high degree as is characteristic of lobar pneumonia.

Naturally the cases presenting a discrete mottling offered the greatest difficulty in interpretation, for we did not have preliminary plates by which an estimate might have been made of the previously existing chronic lesions; such as peribronchial adenitis, chronic parenchymatous, tubercular changes, etc. However, we were soon enabled to identify the mottling by autopsy. It was found to be due to discrete interstitial lesions, commonly held to be streptococcic in origin. In our cases the sum total of mottled types was so small as to be conspicuous.

The total number of patients studied roentgenographically was 470. Of these 82 per cent, or 386, presented hemorrhagic pneumonitis complicated or uncomplicated by one or more of the intrathoracic conditions already noted. Of the remaining eighty-four patients, thirty-three failed to show any lung pathology by the roentgenogram, although clinically there was evidence of so-called bronchopneumonia, seven were Group (*g*) (mediastinal adenitis), thirteen were Group (*i*) (discrete mottling uncomplicated); the remaining thirty-one could not be classified, as the presence of fluid completely obscured the original pathology.

Of the cases which came under roentgen ray observation early enough, the hemorrhagic process was found to appear primarily in the left lung in 82 per cent. This is a striking fact, but no less remarkable than the observation that in our ninety-one cases in which there was unmistakable evidence, the initial invasion appeared in the lower left lobe eighty-five times to six in the upper left lobe.

Group (*a*) includes a few cases where autopsy revealed a small amount of pleural fluid, which roentgenographically was not present twenty-four hours before death. Presumably this developed as a terminal process. The importance of serial roentgenograms in influenza has been amply proven in this clinic, chiefly in detecting and iden-

Roentgen Ray No. 5770 Group (*a*)

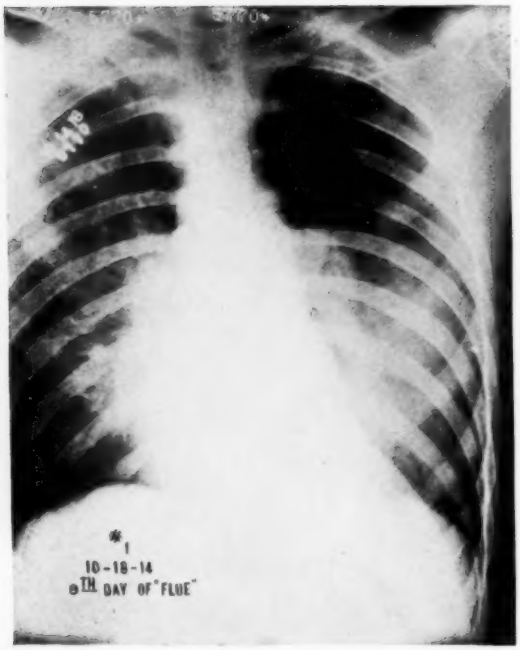

FIG. 1. The initial film reveals the presence of hemorrhagic pneumonitis in the adjacent portions of the upper and lower left lobes and also in the adjacent portions of the lower and middle right lobes. Note that the density is most intense at the hilum and fades out toward the periphery. Note the clearness of the costophrenic angles on the right and left sides.

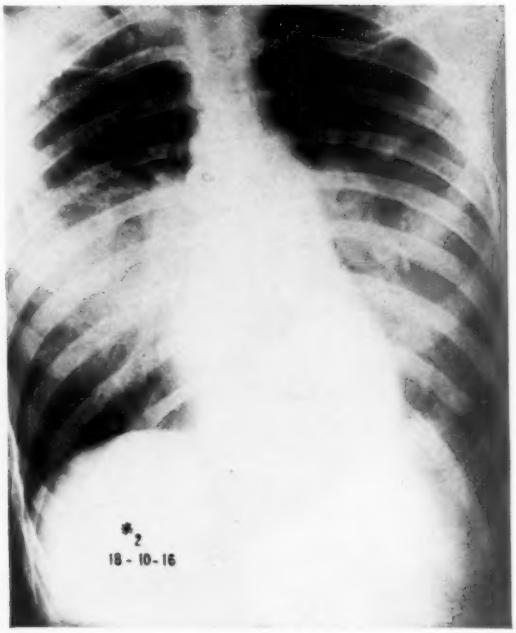

FIG. 2. Compare with Fig. 1 and note the extent of spread in 48 hours.

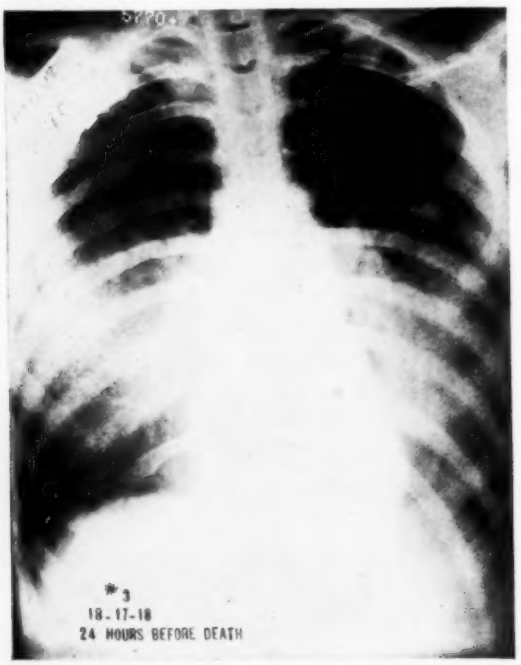

FIG. 3. The patient was too ill to hold his breath and died within twenty-four hours after this examination.

tifying pulmonary complications in the early stages.

We had no deaths from Group (*f*) or (*g*) and so far we have not seen a single instance of fatal influenza unassociated with an intrathoracic complication.

Anticipating possible criticism of this summary on the ground that the clinical, roentgen ray and laboratory findings have not been presented in concerted form, it may be stated that the clinical, roentgen ray and postmortem findings have coincided to a remarkable degree. This will be substantiated by the full report which is under preparation for the Surgeon General and for the medical history of the war.

These roentgenographic studies were stimulated by the extraordinary autopsy findings in the early cases. Authorization was promptly obtained from the Commanding Officer, Colonel E. R. Schreiner, who with Chief of the Laboratory Service, Lt. Col. Nichols, and the Chief of the Medical Service, Major B. M. Randolph, enabled us to bring this to a successful conclusion. We are especially indebted to Captain

Roentgen Ray No. 5765. Group (*e*). A fatal case.

FIG. 1. Shows an early appearance of hemorrhagic pneumonitis in lower left lobe. Note area of increased density projecting from hilum. Compare with Fig. 2, taken twenty-four hours later, and note great increase on 18-10-14. Note the clearness of the apices and the costophrenic angles.

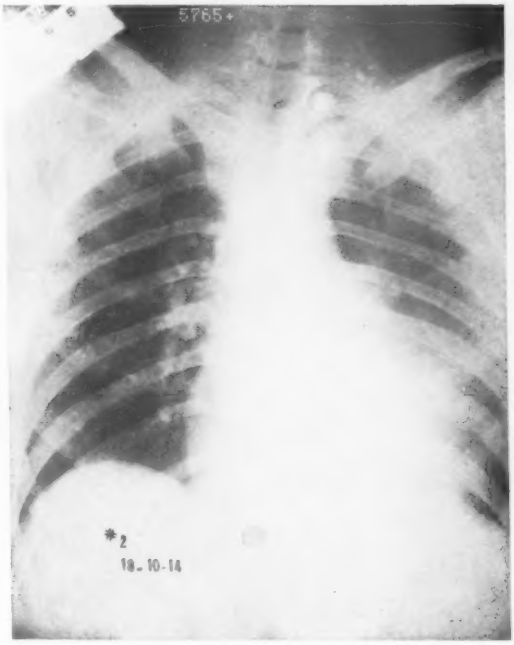

FIG. 2.

FIG. 3. On 18-10-16 shows extensive involvement of lower and middle right lobes, lower portion of upper right and adjacent portions of upper and lower left lobes. The patient was too ill to hold his breath but Fig. 3 illustrates clearness of costophrenic angles and true apex. The patient died twenty-four hours after Fig. 3 was taken.

M. W. Lyon, Lt. J. Harkavy and Lt. Adolphus Rood for their hearty cooperation. We cannot close without expressing our thanks to each and every member of the Roentgen Ray Section, all of whom volunteered to serve in the infected wards and who unsolicited cancelled their engagements that they might devote day and night to the investigation. Lt. Jamie C. Thompson was most successful in organizing the bedside squads and Lt. J. H. Hirsh was equally untiring in furthering this work.

To Major H. E. Ashbury, Roentgenologist, Army Medical School, we are indebted for his invaluable aid in placing at our disposal a sufficient number of roentgen ray technicians to form five bedside squads. The prompt cooperation of Lt. Col. George C. Johnston, Chief of the X-Ray Division of the Surgeon General's Office, enabled us to secure the necessary apparatus in the emergency.

Roentgen Ray No. 5629. Group (*e*). Demonstrating an extensive involvement by hemorrhagic pneumonitis which developed double empyema with recovery.

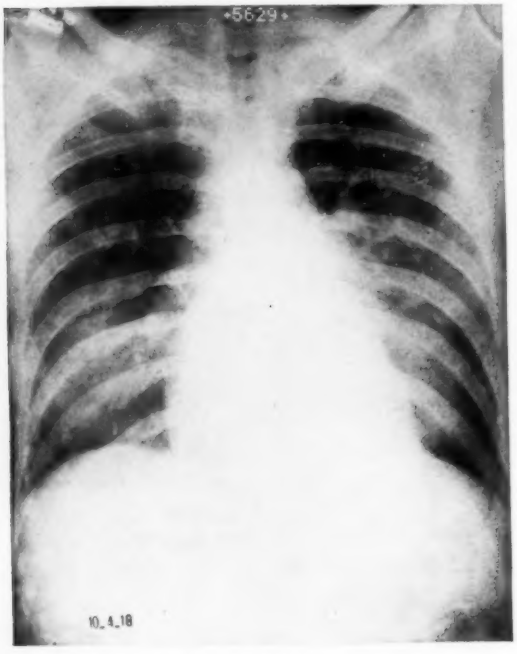

FIG. 1. Extensive hemorrhagic pneumonitis in lower right lobe, lower left lobe, and adjacent portions of upper left lobe.

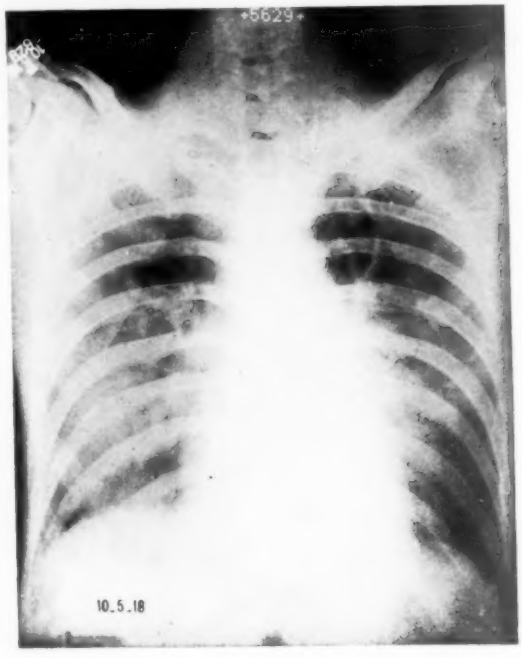

FIG. 2. Compare with Fig. 1 and note extent of spread in twenty-four hours. Both costophrenic angles remain clear.

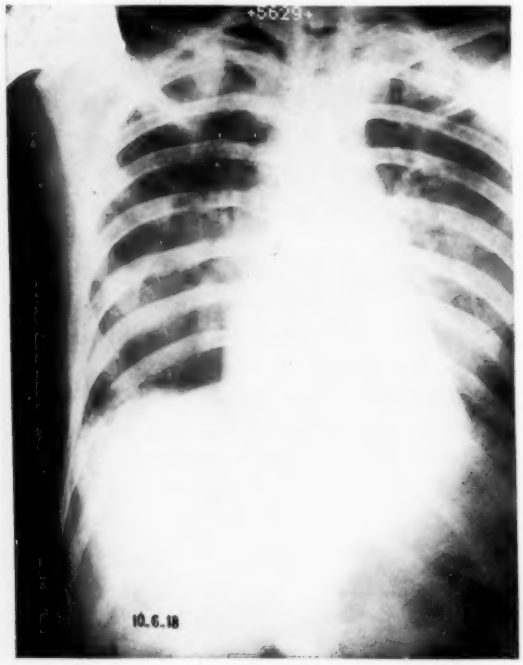

FIG. 3. The right and left chests show great improvement since No. 2.

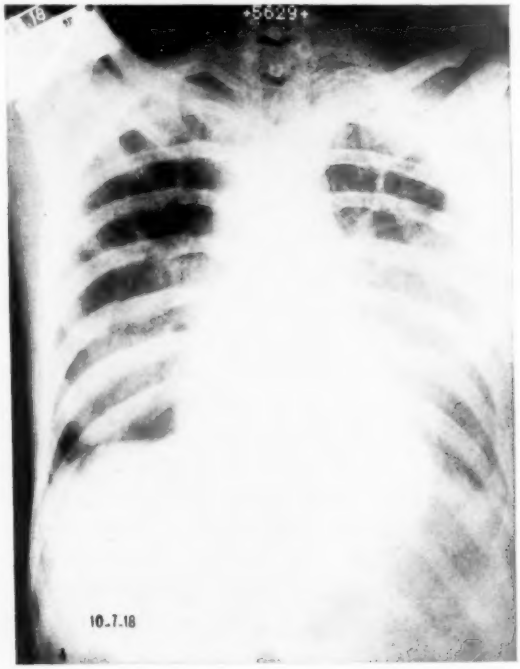

FIG. 4. Compare with Figs. 2 and 3. The hemorrhagic pneumonitis has again spread in left chest and density has increased in right chest.

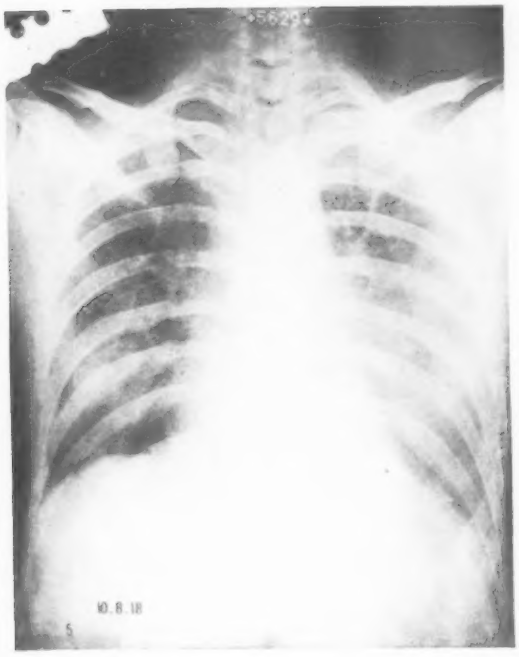

FIG. 5. Interlobar pleuritis has developed between upper and middle right lobes indicated by arrow. (Compare this with Figs. 6 and 7 for confirmation.) Lung tissue in both chests appears more mottled than in any of preceding films. Left costophrenic angle is cloudy.

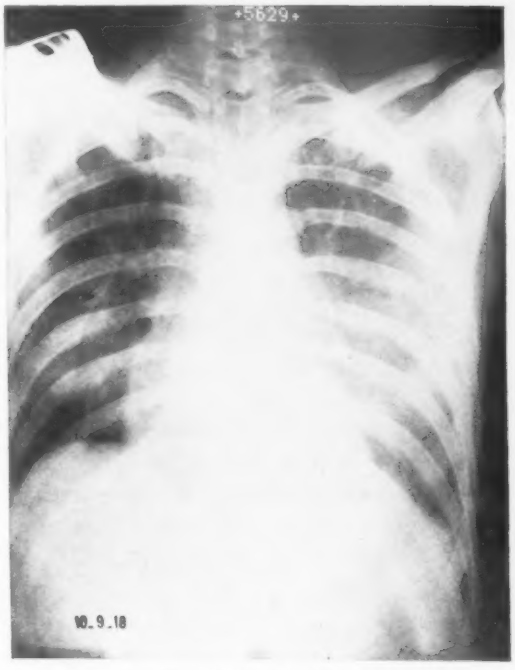

FIG. 6. Very little change since Fig. 5.

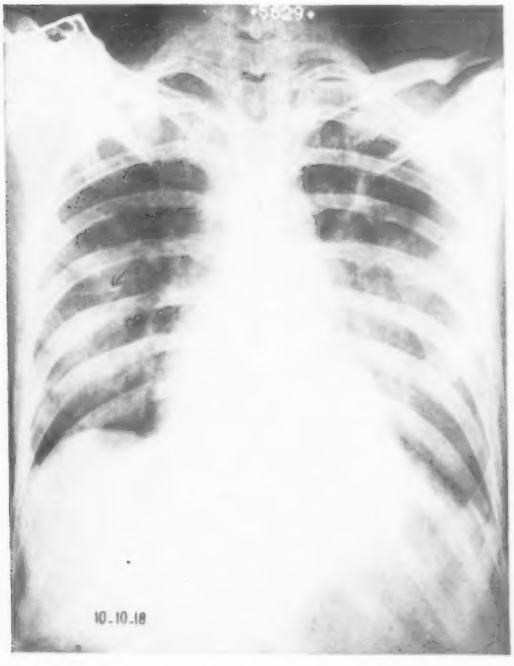

FIG. 7. Very little change.

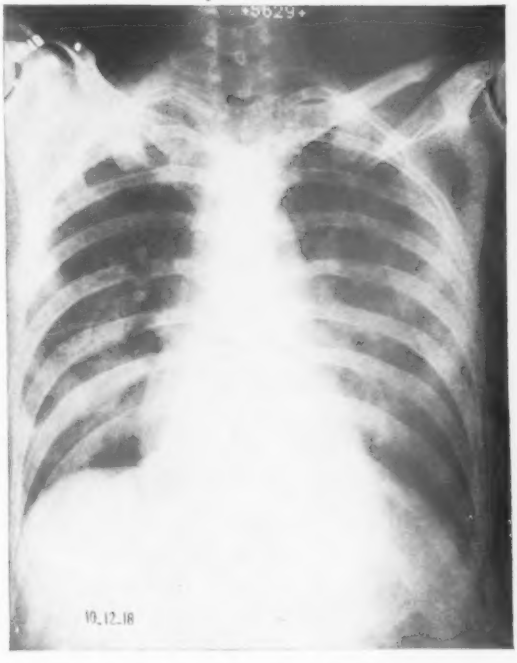

FIG. 9. Very little change since No. 7.

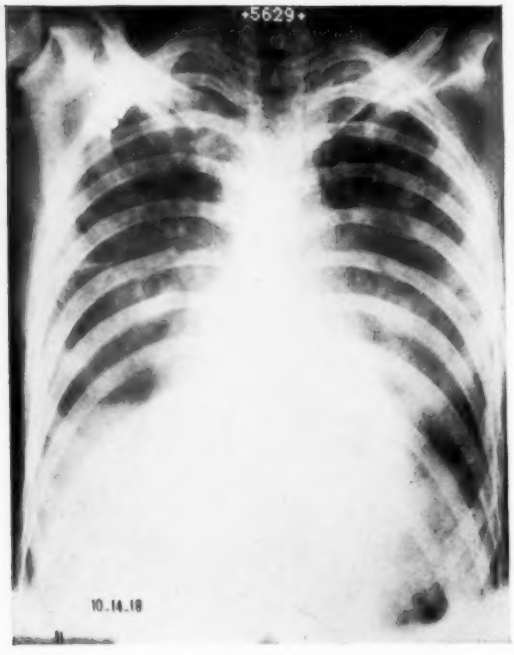

FIG. 11. Practically no change since Fig. 9.

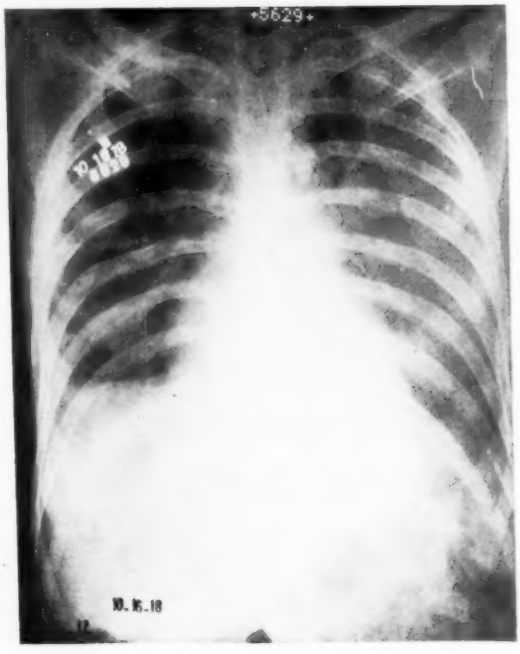

FIG. 12. Left chest is more hazy, including costophrenic angle, than in Fig. 11. Right chest shows pleural effusion. Interlobar pleuritis is conspicuous.

FIG. 15. The right chest remains hazy. Density of the left chest is more marked than in the preceding plate. Fluid is present.

FIG. 16. No appreciable change as compared with Fig. 15.

FIG. 21. Left chest remains dense from second rib to diaphragm.

FIG. 22. Lower right chest has developed an increased density since Fig. 21.

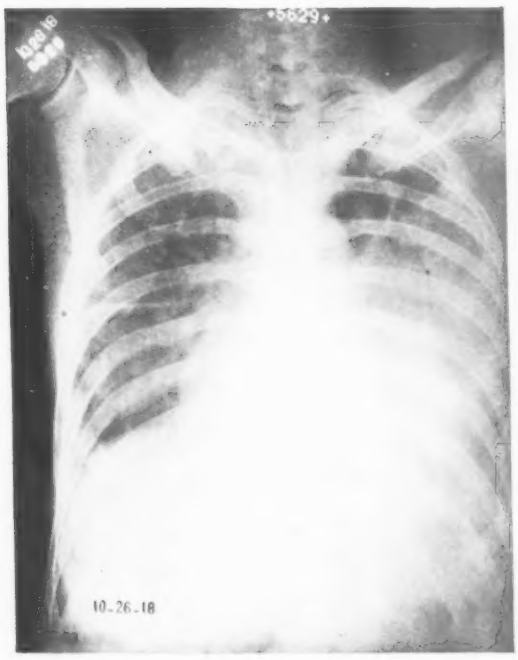

FIG. 23. No change as compared with Fig. 22.

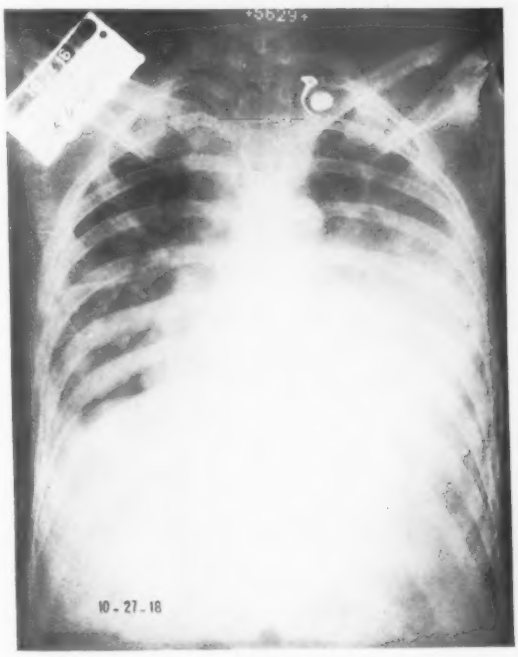

FIG. 24. No change as compared with Fig. 23. Empyema has developed in the lower left chest. Two days after this film was made 1000 c.c. of pus was aspirated.

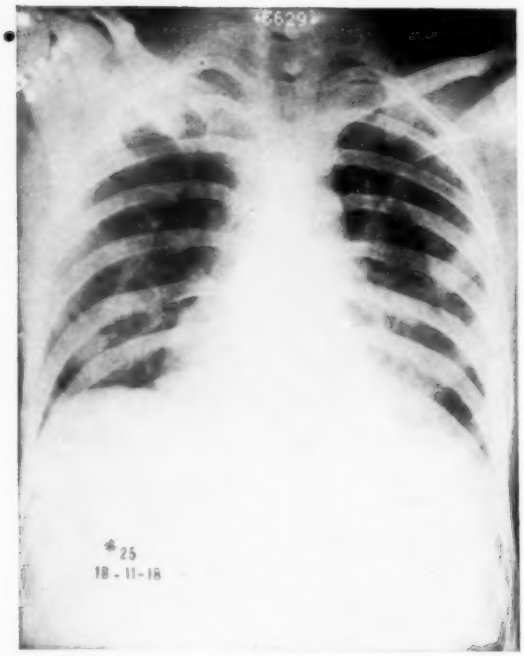

FIG. 25. This film was made nineteen days after Fig. 24. During this time, the empyema was drained. The interlobar pleuritis has almost entirely disappeared and both chests are much clearer.

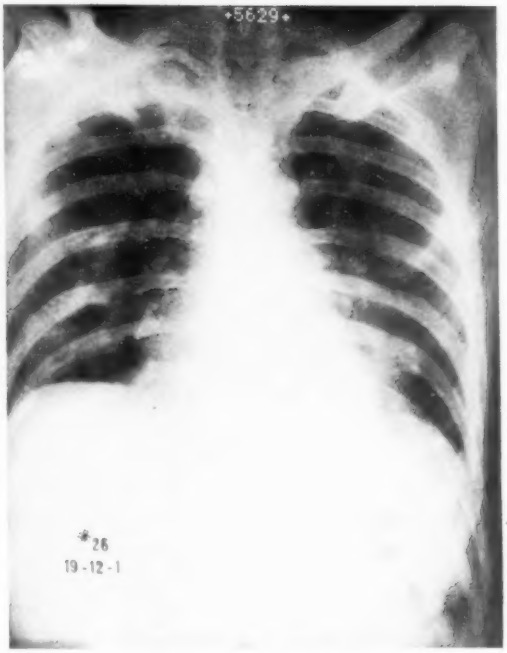

FIG. 26. Continued improvement.

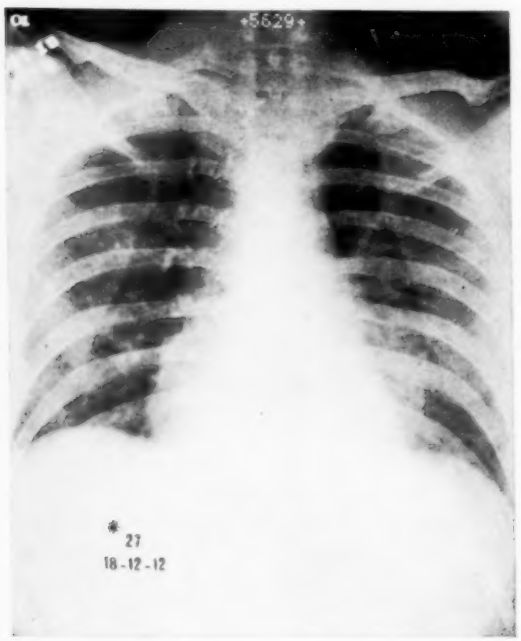

FIG. 27. Both chests are clearing up.

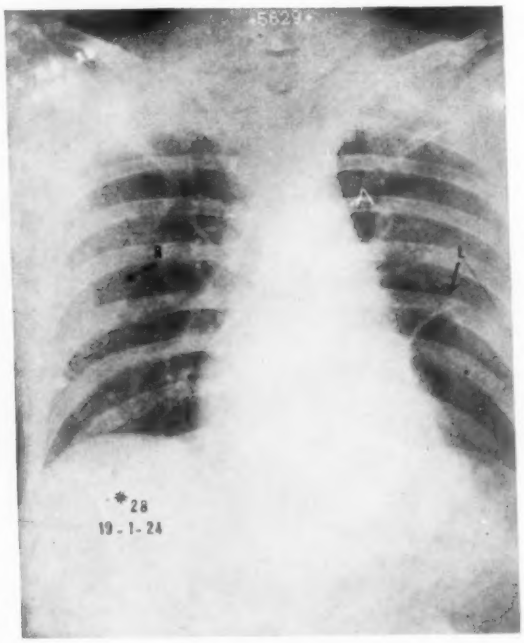

FIG. 28. The right chest is almost clear. The arrow (R) indicates a faint trace of the interlobar pleuritis. Arrow (L) indicates an adhesion developed by the empyema.

NOTE: This case was referred to in the paper as one in which an error in prognosis was made. On the date of Fig. 8, the indications were that it would prove fatal.

Roentgen Ray No. 6882. Group (*e*). This series presents a case in which the lungs remained uninvolved for seven days and then developed hemorrhagic pneumonitis, complicated by pleural effusion, interlobar pleuritis, and empyema, which was confirmed by autopsy.

FIG. 1. No evidence of any pulmonary involvement.

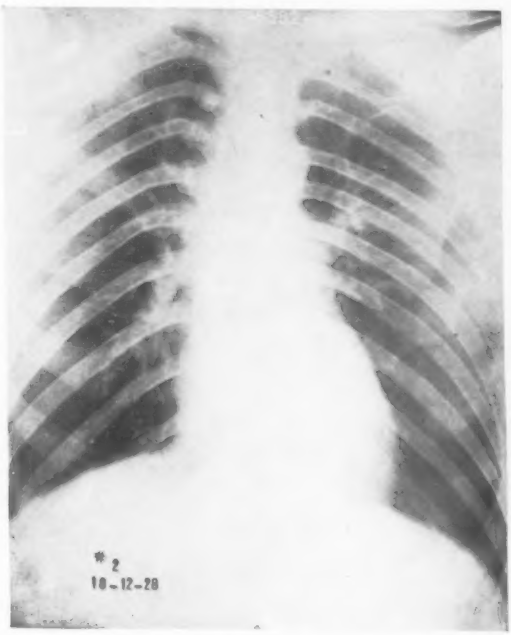

FIG. 2. No evidence of any pulmonary involvement.

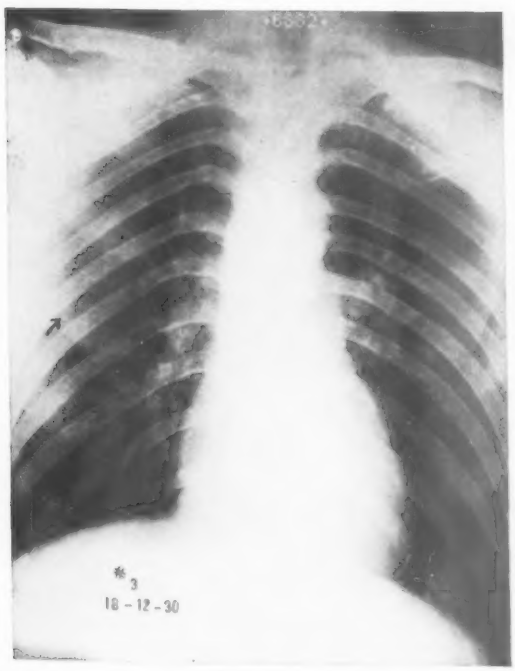

FIG. 3. No evidence of any pulmonary involvement. Shows normal lungs.

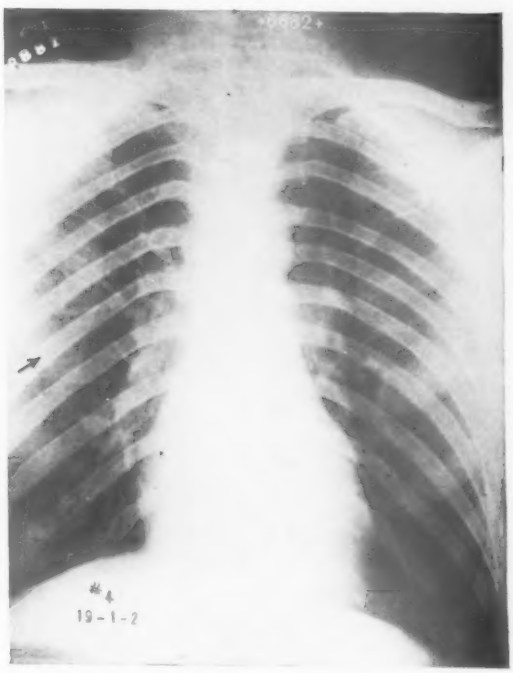

FIG. 4. Shows a beginning interlobar pleuritis betwee upper and middle lobes on right, associated with slight haziness of middle right lobe.

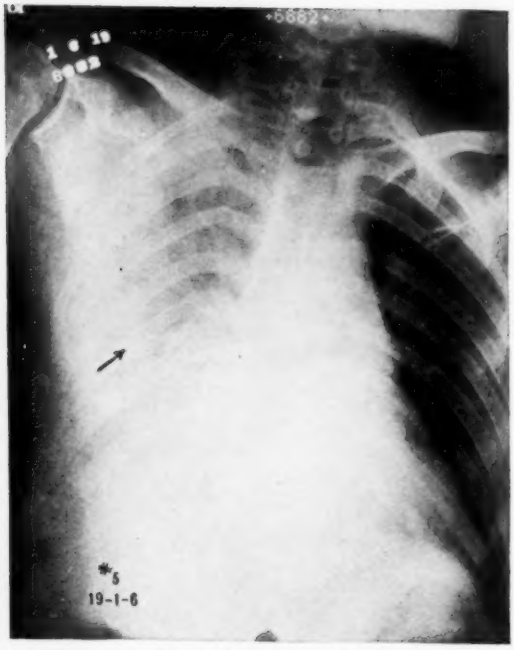

FIG. 5. Four days later, shows extensive involvement of all three lobes on right, costophrenic angle, and apex obscured by fluid. Interlobar pleuritis well developed, indicated by arrow. Lower left lobe shows involvement to less degree than on right. Heart silhouette greatly enlarged and contour changed compared with Fig. 4.

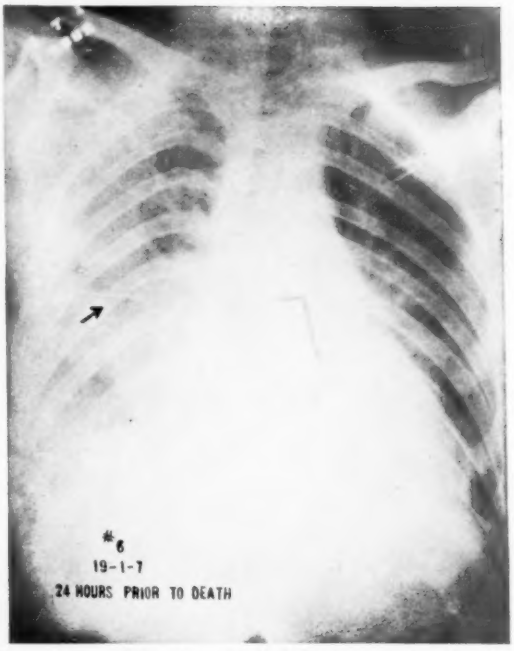

FIG. 6. The right chest is slightly clearer than in Fig. 5 500 c.c. of fluid have been removed since Fig. 5 was made. Lower left lobe is more extensively involved. The patient was too ill for further examination and died twenty-four hours after this film was made

Roentgen Ray No. 6859. Group (*d*). This series of films illustrates a case of hemorrhagic pneumonitis associated with adenitis and mottling. It also presents the complication empyema of the mediastinum and empyema of the lower left pleura.

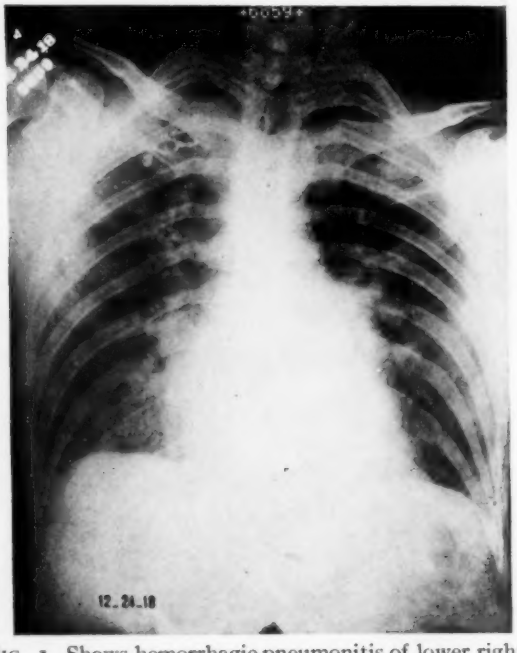

FIG. 1. Shows hemorrhagic pneumonitis of lower right, diffuse mottling of upper and middle right lobes, diffuse mottling of lower and slight mottling of upper left lobe. Costophrenic angle on left is obscured. Mediastinal glands are enlarged. Arrow points to area of abnormal density in mediastinum, which subsequent films prove was a developing mediastinal abscess.

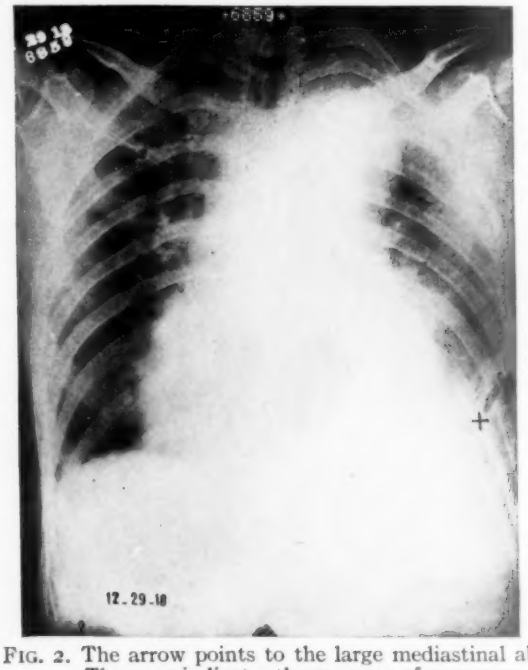

FIG. 2. The arrow points to the large mediastinal abscess. The cross indicates the presence of empyema of the lower left chest. The heart silhouette is greatly enlarged, suggesting pericardial effusion.

FIG. 3. Compare with Fig. 1 and note the discrete mottling which has developed since that date. The mediastinal empyema is unchanged in appearance. The empyema is more extensive than in Fig. 2. Compare this with Fig. 4, made after aspiration of the mediastinum and of the lower left chest.

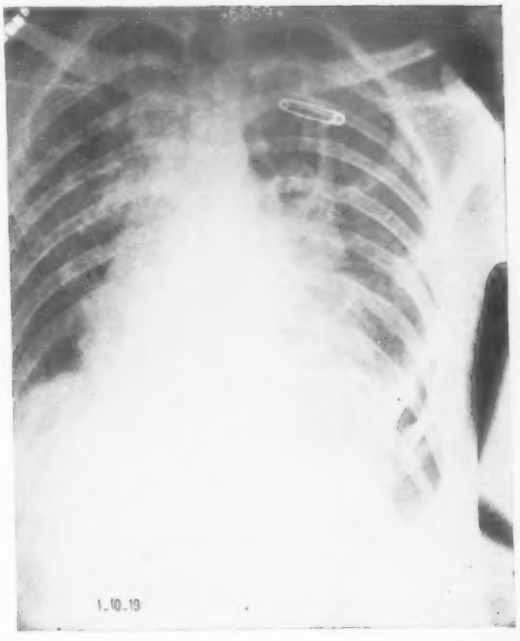

FIG. 4. The safety pin holds the drainage tube in the left mediastinum. The empyema has been completely evacuated from the lower left chest. The lungs are much clearer than in preceding figures.

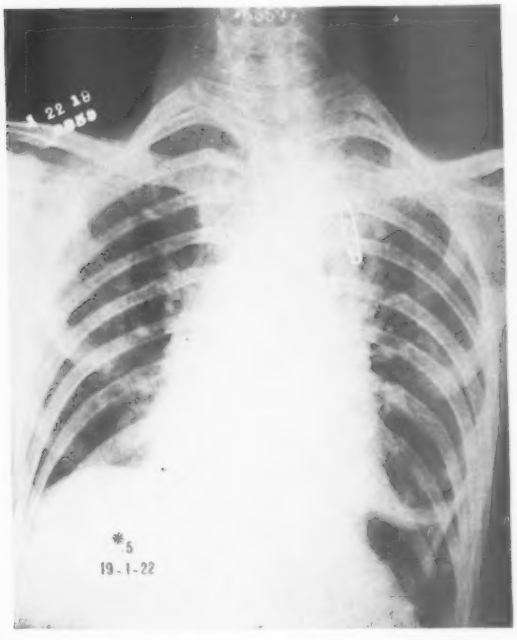

FIG. 5. The lungs are clearing rapidly, adequate draining is being maintained and the chest presents a greatly improved appearance.

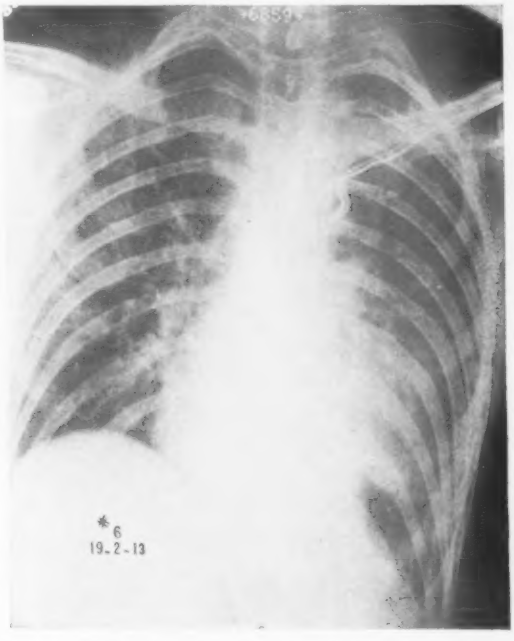

FIG. 6. The mediastinum is practically clear. Note the drainage tube with the wire insert. The safety pin holds a large caliber drainage tube in the lower left chest.

INFLUENZA AND BRONCHOPNEUMONIA

A STUDY OF THE EPIDEMIC FROM A ROENTGENOLOGICAL POINT OF VIEW

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THE opportunity to study influenza from a roentgenological point of view has been exceptional. The conditions under which the study was undertaken were most favorable on account of the interest of the Commanding Officer, the cooperation of the Staff and Ward Surgeons, the absolute control of the patients, the close relations with the Pathological and Bacteriological Department, and the reliability of the staff of the *X*-Ray Department.

Introduction.—This study was undertaken in a modern hospital thoroughly equipped with a really practical system for taking care of patients and their records. The roentgenological examination of the patients was possible because of a U. S. Army bedside roentgen ray apparatus which enabled the Department, as a matter of routine, to examine the patients with very little disturbance, from the beginning of the attack until recovery or until the patient succumbed to complications. The very earliest cases were roentgenographed in the Department in the upright position and later in bed in the prone and upright positions. Those cases that had a final examination were, of course, taken after the patient had been returned to duty, and were taken in the Department in the upright position again. This study therefore covers a number of cases from the earliest onset of influenza to the full development of the disease and the later period from the time when the patient developed a bronchopneumonia to recovery or to autopsy, every case coming to autopsy having a post-mortem roentgenological examination. Consequently the three types of pulmonary changes to be studied are those produced by influenza, bronchitis, pneumonia and other associated processes. As this institution is primarily for tuberculosis cases, the after effects of influenza and pneumonia on the tuberculous processes had to be borne in mind.

Review of the Literature.—As far as could be determined, this shows no reference to a study having been made of the epidemic from a roentgenological standpoint. A clinical and pathological study of previous epidemics, last spring and early fall of this year, in military camps in the United States and at naval hospitals abroad gives evidence of considerable value for the present study. I should especially like to call attention to the abstracts of foreign literature on influenza compiled by the British Medical Research Committee concerning the pathology of the disease. It was found that the same short period of incubation, the rapid and sudden onset and the general trend of symptoms were the same. It was found that it was a common occurrence to have a remission the second or third day; that after this a coryza occurred with bronchial cough; that approximately one week later the patient became normal; also that bronchopneumonias developed most frequently after the second remission. The occurrence of bronchopneumonia in these epidemics was approximately 5 to 10 per cent with a mortality of approximately 60 to 70 per cent. Empyema or purulent processes occurred very seldom, but in the terminal stages of the disease a sero-fibrinous effusion into the pleural cavity, which was

*Authority to publish granted by the Board of Publication, Surgeon General's Office, Washington, D. C.

usually unilateral and most often on the right, occurred quite frequently.

What is of specific interest to this particular study is that clinically the process of bronchopneumonia appeared as a continuation of the bronchitis which was present in a large percentage of cases, and that in cases of progressive or extensive involvement, the patient rarely recovered.

Consolidation occurred most often in the right lower lobe just medial to the inferior angle of the scapula, next affecting the left lower lobe, then the right upper and middle lobes, and finally the left upper lobe.

MacCullum, reporting on the pathology of the epidemic *Streptoccocal Bronchopneumonia in the Army Camps*, gives a very clear description of these processes. This must be thoroughly understood to appreciate the changes brought about as seen on a roentgenogram. He states that the most characteristic lesions appeared; that at necropsy there was found most intense congestion of the whole respiratory tract; a nodular consolidation could be felt throughout but especially in the posterior parts of the lungs. On section the bronchi contained a gray purulent exudate. They were markedly dilated toward the periphery. The mucosa was a deep, purplish gray. All showed thickening of the walls and the terminal bronchioles were especially thickened so that with the adjacent alveoli they projected in cross section in the form of small firm nodules. Such dense peribronchial nodules were nearly always surrounded by hemorrhage. Often in these very fresh cases there were occasionally small areas of more homogeneous consolidation. Microscopically the lumen was found to be filled with an inflammatory exudate of leucocytes, blood and bacteria and in the infiltration and thickening of the walls of the bronchioles were mononuclear wandering cells. Great hyperemia and edema of the bronchial walls was seen accompanied by a less evident new formation of connective tissue cells. The adjacent alveoli, so far as they were not filled with red blood corpuscles, were compacted with mononuclear cells and dense fibrin. The alveolar walls were infiltrated with mononuclear cells and were widened.

Keegen, reporting on the prevailing pandemic of influenza, states that on autopsy these cases showed a massive bronchopneumonia simulating lobar pneumonia, from which a large quantity of blood exudated from the cut surfaces. He also states that the heart in only one case out of thirty-five was acutely dilated.

The British Committee abstract states that: "In the initial stage of the affection of the lungs, namely, when only small foci without any great reaction in the immediate neighborhood were observed, the most striking findings were small, bean-sized hemorrhages projecting into the lung tissue. As a next step there followed a firmer infiltration of the parenchyma, the nodules sitting subpleurally and raising the pleura in consequence. A whole scale of intermediate formations lay between these small nodules and large hemorrhagic tuberous infiltrations; all possible gradations were observed from simple blood extravasations into the lung tissue, still containing air, to firm, almost dry, infarct-like hemorrhages of a bluish-black tinge. These extensive infiltrations were of the same shape as the usual pulmonary hemorrhagic infarcts, namely, they had the form of a wedge with its base resting on the pleura, thus clearly indicating an intimate relationship with the vascular system of the lungs.

"The second stage was characterized by exudative pneumonic processes combined with hemorrhages. There may be a true croupous hepatization of lobular, or even lobar, extent, both red and gray. These pneumonic infiltrations usually embraced in their center circumscribed hemorrhages.

"The bronchi were filled with pus already in the first stage, the smaller branches containing thin fluid, though at times dried-up exudates formed firm plugs occluding the lumen of the bronchioles.

"The pleura participated in the process. The first signs consisted in punctiform hemorrhages, or ecchymoses; serous exudations followed next, and, as often as not, empyemas completed the picture. As a rule, one side only was affected. Pericarditis was a natural consequence of pleuritis. There were no gross changes in the heart save for some thickening of the arteries of the lung hilum.

"The larynx and the upper third of the trachea showed no involvement in the process. The lower portion, however, was the seat of an intense mucopurulent exudation, which in many cases assumed a fibrinous character, with the consequent formation of extensive pseudomembranes in the lower trachea and down into the bronchi. Sometimes edema of the epiglottis was observed. Marked lymphatic changes were also observed with enlargement of the cervical and axillary glands.

"The foci of inflammation in the lungs showed a leukocytic infiltration around the alveoli, bronchi, and the walls of small arteries. It did not involve the whole vessels, which were dotted with isolated spots of infiltration. There were also hemorrhages into the heart valves, with a consequent displacement of the fibers and damage to the endothelium; thus no definite endocarditis, but lesions, which facilitated the development of a secondary mycotic endocarditis."

It is evident from the review of the literature that limited information from a pathological point of view was obtained as to the direct results on the parenchyma tissue due to influenza alone. The changes usually described invariably mean changes seen in bronchitis with development of a broncho- or lobar pneumonia and after results. Although the study of clinical and pathological reports of past epidemics is interesting, there appears to be a distinct difference as compared with the last epidemic and these differences as they affect the roentgenological diagnosis will be pointed out later.

As far as the causative factors are concerned, there apparently is still discussion; but in this investigation it is assumed that the bronchopneumonias were due to the pneumococcus and the changes expected would be no different from bronchopneumonias seen roentgenologically under ordinary conditions.

The Present Problem.—It became apparent that roentgenological examination would only be of value in the very earliest cases of beginning bronchopneumonia and also in determining the extension of the process from one lung to the other or from one lobe to another. The study, therefore, was undertaken with these points in view, namely: (1) What the appearance of influenza was; what changes were brought about, whether consistent, and how these changes progressed; as well as what the associated changes were in adjacent tissues or organs. (2) How early, if possible, could a bronchopneumonia be detected; what its progress was; what part of the lung was most actively affected; associated tissue changes, cardiac changes, diaphragm changes; and whether progressive improvement was noticed in the lung not affected by a pneumonic process but previously affected by influenza. (3) Whether the marked bronchial changes noted due to influenza would determine the type of pneumonia, that is, whether the bronchial changes would be sufficiently early to show when the bronchioles became affected and whether these changes would determine the changes characteristic of a broncho- or a lobar pneumonia.

Class of Cases Studied.—This consisted of corps men, patients, and staff. From September 24 to November 4, 260 cases of influenza occurred. Of these 118 were corps men, 37 Students' Army Training Corps men, 67 patients, 17 nurses, 13 medical officers and 8 miscellaneous. Of these 260 cases, 91 cases were studied roentgenologically. In the 260 cases there occurred 66 cases of pneumonia. Of these 91 cases, there were 52 cases of bronchopneumonia and 4 cases of probable bronchopneumonia. These occurred among the

following classes: Of the 55 corps men, 36 had bronchopneumonia; 2 had probable bronchopneumonia; one had probable lobar pneumonia; and the remaining 16 had influenza and congestion.

Of the 8 nurses studied, 6 developed bronchopneumonia; 2 recovered as influenza and congestion.

Eleven medical officers were examined and of these, 2 developed bronchopneumonia; 2 had questionable bronchopneumonia; 1 had a probable lobar pneumonia; 6 had congestion and influenza.

Of the 15 tuberculous patients, 7 had bronchopneumonia; 3 had pneumonia (type undetermined) and one had a probable bronchopneumonia; 4 continued as influenza with congestion.

The cases studied depended largely on the clinical signs and symptoms presented whether suitable for serial roentgenological study, questionable clinical diagnosis, or whether atypical in type. It will be seen from these numbers that 28 cases of influenza and congestion were studied. The rest actually became cases for the study of pneumonic processes. The examinations varied in number from one to ten. In the case of influenzas and congestions, these examinations often were taken every day while the bronchial changes progressed, until the patient recovered, or until a pneumonic process developed, examination being less frequent after a definite diagnosis of the process was made. In the case of a pneumonia being diagnosed on first examination, repeated examinations were then made to determine the progress of the disease until the final stage had been reached. In only one case did an empyema develop. Several cases developed fluid in the chest, probably of pleural origin, and most rapidly in the serious cases that finally came to autopsy.

A full report was made each day after original description of the roentgenogram, and the clinical evidence was carefully considered and discussed so that both the medical officer, staff and student officers and department staff could get the most value from these discussions. Very ideal conditions, therefore, prevailed for the study of influenza and its complications and there was extremely close cooperation between the clinical and roentgenological staff.

Influenza — Roentgenographic Appearance.—On examination of the roentgenograms there is seen to be a general increase of density throughout the lungs. This density may be described as being of a hazy or smoky nature which decreases the contrast between the normal lung transparency and the bronchial tree outline. This generalized density is somewhat greater from apex to the base, inner half, and especially adjacent to the mediastinal border, thus obscuring to some extent the mediastinum and cardiac outline. The most marked changes are seen in the bronchial structures themselves. A greater number of vessels are seen than is usual in any other disease. They are more definite although diffuse in outline. This peribronchial thickening, however, is seen most markedly around the hilus, extending outward in "sunburst" type and rapidly diminishing in size from the hilus to about the outer one-third of the lung. The peribronchial thickening extends upward parallel to the mediastinum and helps to obscure the mediastinal outline. The greatest thickening and greatest diffuse bronchial density is seen at the base, extending downward from the hilus, reaching the diaphragm outline and extending to just beyond the mid-clavicular line. This is more marked on the right than on the left, largely because the left is obscured by the heart, but probably also because the larger number of cases of marked bronchitis or bronchopneumonia occurred at the right base, and partly because of the anatomical difference between the right and left bronchial structures. The diffuse density of the bronchial outline, although becoming most marked in some cases, never showed a "pussy-willow" effect unless a bronchopneumonia was develop-

ing. The distribution of the bronchi could be fairly well traced out but the difference between the bronchi and parenchyma is most often diminished.

In cases where influenza progressed as influenza towards recovery there is a gradual diminution, first, in the hazy generalized density and then in the diffuse density of the bronchial structure. The density around the hilus, due partly to peribronchial thickening, remains considerably longer. The hilus becomes affected very early. There are an immediate enlargement of the hilus and a marked increase of density with irregular outline, so much so that in no case is there any question of the reaction of the hilus. The irregular outline is due to peribronchial thickening.

In a few cases there is definite enlargement of glands at the same time in the hilus region.

The mediastinum in some cases is somewhat increased in width and, as previously described, the outline is shown to be increased in density.

The diaphragm is, if anything, more dome-shaped; that is, the convexity is increased and the cardio-diaphragmatic angles become more acute. Also there is some obliteration of the costo-diaphragmatic sinuses.

The heart shows a slight dilatation of the right auricle and, to a less extent, a slight dilatation of the pulmonic area. The heart as a whole is not enlarged.

The appearances as described are typical and consistent—so much so that a diagnosis of influenza and congestion could be made in almost every case, and a diagnosis of influenza and congestion was made in several cases before there were any clinical signs to warrant such a diagnosis; and in two cases of tuberculosis a diagnosis of influenza and congestion was made a week after onset of the disease and when tuberculosis was the only clinical diagnosis. In a few cases the changes were very light and these invariably were cases that led to a speedy recovery. Unilateral congestion was seen in a few cases and these invariably recovered within a few days. In one case, an influenza suspect, a diagnosis of bronchitis was made and later clinically verified; and in another, a diagnosis of transitory congestion was made and within forty-eight hours verified. This proved to be a case of serum reaction. These cases are quoted to emphasize the specific value of the roentgenological changes in influenza.

The appearances, therefore, of the lungs and bronchi show a very early and marked congestion of the parenchyma and bronchial tissues. It is an active congestion as the bases in none of the cases show a greater congestion than the middle or upper portions. It also shows that the lower bronchial structures and the bronchi of large diameter are earlier and more markedly affected than the smaller and terminal branches. It shows also a marked lymphatic and glandular congestion and reaction as demonstrated by changes in the hilus area and a diminution in pulmonary function as evidenced by the height and shape of the diaphragm. The cardiac changes also bear out the early congestion of the lungs. The changes in the bronchi in early bronchopneumonias will be taken up under the study of bronchopneumonias.

Bronchopneumonia, the Appearance of.—As previously stated, there were 91 cases of influenza, and of this number 52 were cases of bronchopneumonia and 4 cases of probable bronchopneumonia. Of the 4 probable bronchopneumonias, 2 resembled true lobar pneumonia. In the most typical cases, those developing gradually, the first changes seen, after those described under influenza, are apparently bronchial in nature. There is a greater irregular diffuse peribronchial thickening so that the individual outline of the bronchi can be made out with difficulty. Then there occur small, more or less localized areas, most visible in the middle of the lung, 6 to 8 cm. distant from the hilus, but in very early cases occurring nearer

the hilus and most often in the lower part of the lung. These localized areas superimposed and adjacent to the bronchial outline resemble somewhat the "pussy-willow" stage in the budding of the willow branch seen in spring.

The next distinct stage is a spreading out of these areas to a confluent, more or less localized area, varying in size from approximately 3 to 6 cm. in diameter. If this occurs in the full pulmonary field, the localized congestion appears light and hazy, not unlike a "powder-puff" in appearance, with an irregular, soft, diffuse outline. In a few cases resolution begins in this stage; but in the majority of cases the process progresses, the density increasing and detailed structures becoming obscured. The bronchial outline is no longer visible and pulmonary changes become more extensive and definite. In short, a pseudo-lobar pneumonic appearance is seen. If this occurs at the base, the heart and diaphragm outlines are obscured, the sinuses are obliterated and the density from apex to base becomes gradually greater. It frequently occurs that, after one portion of the lung has become consolidated and the process progresses, the next earliest changes are seen on the opposite side, extending outward from the hilus after primary hilus changes, in the same manner as previously described. Associated with the early bronchial changes there are marked changes in the hilus on the side where these bronchial and pulmonary changes begin. The hilus becomes more dense and more definite in outline, as well as increasing in size. In comparison there is a distinct difference in the hilus on the opposite side, if the process involves that lung. When the process becomes extensive, the hilus outline becomes obliterated.

Progressive changes in the lungs in advanced cases are of less interest. As consolidation increases, the density naturally also increases and the outlines and details of structure disappear.

In the marked changes of bilateral pneumonias where the greater portion of both lungs is affected, the bases become so dense that a differential diagnosis between an extensive edema, pleural effusion and pneumonia, as such, cannot be made.

Two associated changes occur very early in the onset of pneumonia which are of great interest and importance. Invariably as early as the changes occur in the hilus there is seen in the heart a marked and acute dilatation of the right auricle and also dilatation of the pulmonic area. In a number of cases dilatation of the aorta also occurred. In a few cases in the later stages, dilatation of the left ventricle was also seen. Reference to the tables will show the number and type of cases in which these changes were observed.

The second associated change has to do with the position and shape of the diaphragm. In the majority of cases the diaphragm on the side affected becomes more dome-shaped and its position is from one to two interspaces higher than normal. This was so marked and occurred so frequently that emphasis was made of this in the diagnosis of cases. In massive types of pneumonia the diaphragm was often lower than usual.

The changes described therefore show the bronchial congestion first with associated hilus changes; then localized congestion of the bronchioles; and lastly the congestion of the true parenchyma. The early dilatation of the heart accentuates the acute and rapid congestion of the lungs and the marked changes in the diaphragm also indicate the early impairment of respiratory function on the side affected. In a few difficult cases there was some difficulty in differentiating true bronchopneumonias from the lobar type and it was only possible to make a differential diagnosis after resolution began, as it is well known resolution in lobar pneumonias begins near the hilus and retrogresses towards the periphery, whereas in bronchopneumonias this is reversed.

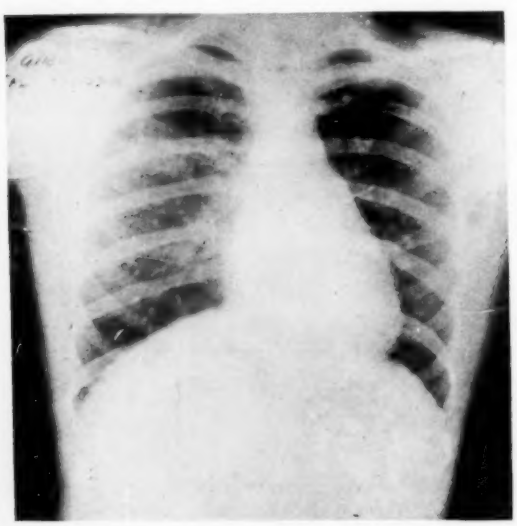
What is of special significance and of aid to the clinician is the verification of

CASE 512. First Examination.

suspected bronchopneumonias based on very slight changes in breathing over localized areas with occasional râles. In a number of cases roentgenological examination showed areas of congestion as described before clinical evidence was presented. The consistency of the changes stated become also of considerable prognostic value. It is found that if these small diffuse areas of congestion occur widely distributed around the hilus of a more irregular and faint type, these cases invariably progress to massive types of pneumonia rapidly and more intensively.

It is equally true in cases where the bronchial changes are less evident and the parenchyma changes greater. The prognostic value of the changes in the lung and hilus as well as in the diaphragm are also seen during resolution. The return to normal of the right auricle and the pulmonic area after dilatation seen during the acute pulmonary changes is exceedingly slow. It was of extreme interest to consult the clinician as to the changes found from day to day and to determine the accuracy of the physical signs with the consistency of the changes as shown by the roentgenogram. The consistency of these changes and their frequency can be seen by referring to the tables.

Lobar Pneumonia.—In the four cases presented in which a diagnosis of bronchopneumonia could not be made, a definite lobar type of density occurred, more or less demarcated, localized to a lobe, limited by the interlobar fissure, and with the greatest density occurring at the



CASE 512. Second Examination.

CASE 512. Third Examination.

periphery and gradually less toward the hilus. In two of these cases the diagnosis of bronchopneumonia was made only after resolution had begun. In the remaining two cases the diagnosis of lobar pneumonia stood.

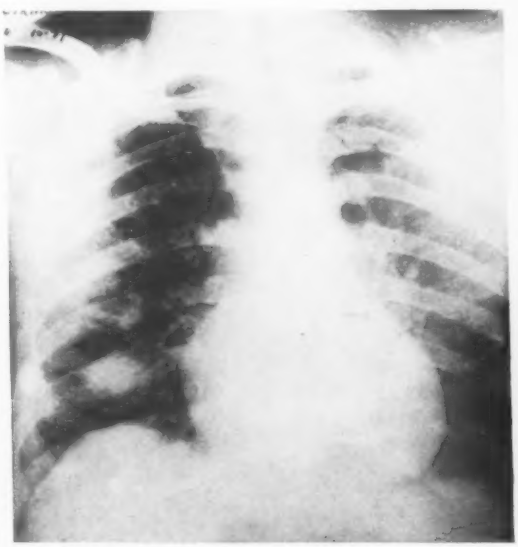
CASE 540. First Examination.

CASE 540, Second Examination.

It is well to point out here the importance of an early roentgenological examination to determine the type of pneumonia, that is, to determine the bronchial changes before parenchyma changes and before these small areas of density become confluent and the congestion so great as to simulate a lobar pneumonia.

Pleural Changes.—In a few cases a pleural reaction was demonstrable. This can, of course, only be demonstrated in the interlobar fissure where any congestion or thickening of the pleural surfaces can be detected, and it is largely due to the fact

CASE 540. Third Examination.



CASE 540. Fourth Examination.

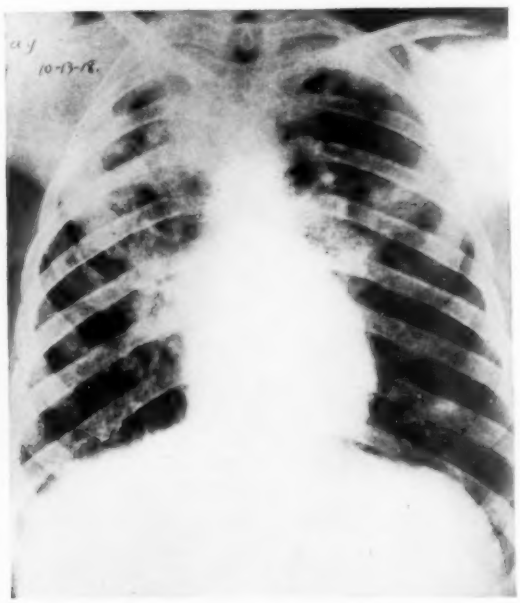
that the position of the interlobar fissure gives depth to the pleura, and depth with congestion is necessary to give a shadow on the roentgenogram.

CASE 540. Fifth Examination.

CASE 540. Sixth Examination.

An unusual opportunity was presented, however, to demonstrate the early congestion of the pleura in influenza. A case of tuberculosis with a complete unilateral pneumothorax without adhesions became affected with influenza and was examined roentgenologically. This was a case in which a previous roentgenogram had been made before the attack of influenza so that a comparison between the roentgenograms could be made. There was a marked congestion of the pleura throughout, which on con-

CASE 430. First Examination.

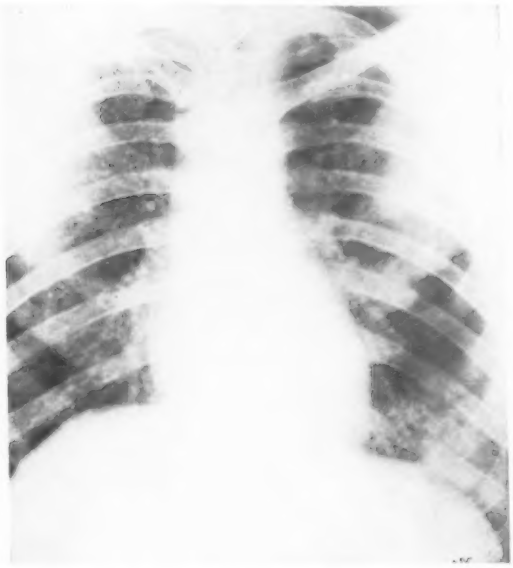


CASE 489. First Examination.

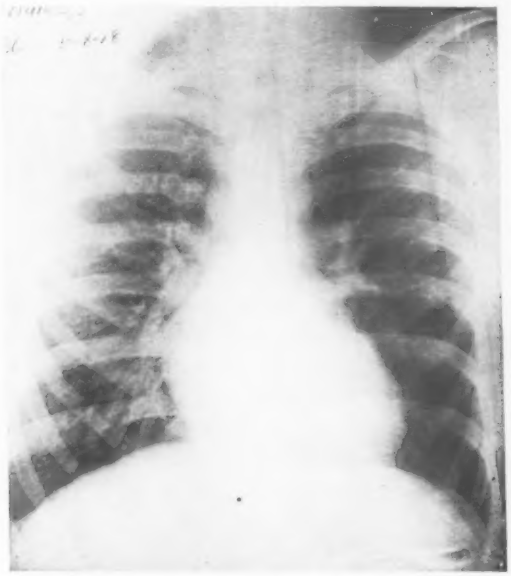
secutive examinations grew greater and then gradually receded. This was associated with a congestion of the opposite lung and acted as a control in the study of the pleural congestion. Reference to the autopsy findings in the later part of this report will show how frequently pleural affections occurred.

Sequelæ.—Under this heading two conditions may be considered, mediastinal and pulmonary changes. It has been pointed out in the preceding pages what marked changes occur in the hilus and mediastinum and from the pathological abstracts quoted the changes in lymphatic tissue and glands have been significant. From observation of the cases recovering, the attention of the medical staff was called to the slow improvement and gradual changes in the lungs, and the persistency of the congestion of hilus and mediastinum. A suggestion was made, therefore, to the clinician that the presence of d'Espine's sign would be an indication of this condition and a sign of some prognostic value. This suggestion has been followed and although a complete report cannot now be made, d'Espine's sign has been found to be present in approximately fifty per cent of all cases examined. The second condition is the possibility of tuberculosis occurring after the disappearance of acute pulmonary processes.

Tuberculosis with Influenza and Bronchopneumonia.—At the outset a diagnosis of influenza or bronchopneumonia is extremely difficult to make unless the tuberculous lesion is an apical one and not of recent activity. In cases of fairly advanced tuberculosis or tuberculosis showing active processes with congestion the interpretation of a roentgenogram to differentiate these lesions from those produced by influenza or bronchopneumonia is well-nigh impossible. In the cases of tuberculosis that had roentgenograms previous to the attack of influenza a comparison, of course, can be made and in the majority of cases a diagnosis of a more acute condition is possible. In all the cases developing into a lobar form of bronchopneumonia a definite diagnosis can be made. In the cases which have led to recovery there have been observed differences in density and structural changes at the site of old tuberculous lesions, mainly apical, which suggest a field of work which will be of considerable value.



Case 362. First Examination.



Case 436. First Examination.

From the evidence already obtained concerning pulmonary apical changes, two conclusions may be drawn—either that there is renewed activity of an old tuberculous process due to the superadded acute infection; or that a congestion exists at the site of a tuberculous lesion which is more permanent in character than the influenza congestion and which may lead to active tuberculosis in case the patient is not placed under observation and care. A study of these cases and those coming to autopsy will be made later. It has been likewise difficult to determine the effect of the acute process on the hilus and diaphragm, as part of these changes may possibly be due to the tuberculous process. Dilatation of the right auricle and pulmonic area, however, was noted in all the cases.

Postmortem Findings.—Of the 11 cases that came to autopsy, 3 occurred among patients and 8 among corps men. The 3 tuberculosis cases developed bronchopneumonia. All three cases had postmortem examinations and the diagnosis of bronchopneumonia verified. Marked pleuritis and acute bronchitis occurred in all three. There was edema of the lungs in two cases. There was acute dilatation of the heart in two cases.

Of the 8 cases occurring among the corps men, 7 had post-mortem examination. In all eight a diagnosis of bronchopneumonia had been made and this diagnosis verified by autopsy. In 6 cases acute bronchitis was found and in 3 acute dilatation of the heart, and in 7 edema of the lungs or pleural effusion was found.

The condition of the lungs and bronchi found on roentgenological examination corresponds closely to the findings of MacCullum and Keegan and others. The protocols of the autopsies made here have omitted the position of the diaphragm, but in the majority of cases the extreme height of the position of the diaphragm was verified. The marked edema or pleural fluid corresponds to the roentgenographic density at the bases of the lungs. The extent of the pneumonic processes varies but slightly. The large amount of bronchial exudate and thickening of the bronchial walls correspond well with the roentgenographic description given in the study of influenza. Dilatation of the right auricle was very perceptible on opening the thoracic cavity and this is a distinct point of difference from previous postmortem findings but it bears out the roentgenological findings. The pleural reaction as already described was evidenced by the amount of pleural secretion and pleural fibrin organization

Case 473. First Examination.

especially between the lobes, although not nearly as marked as occurred in the previous bronchopneumonic epidemic seen. The enlargement of glands was found in one of the ten autopsies. In short, autopsy findings verify the conditions in detail as described by roentgenological examination.

Clinical and X-ray Diagnosis Compared with Final Diagnosis.—(Includes all groups.)

1. Clinical diagnosis bronchopneumonia, with *x*-ray diagnosis agreeing and confirmed by final diagnosis 16
2. Clinical diagnosis influenza, with *x*-ray diagnosis agreeing and confirmed by final diagnosis . . 18
3. Clinical diagnosis lobar pneumonia, with *x*-ray diagnosis agreeing and confirmed by final diagnosis:
   Clinical diag.—Lobar pneumonia.
   X-ray diag.—Lobar pneumonia and fluid
   Final diag.—Lobar pneumonia and fluid . . 1

4. Clinical diagnosis bronchopneumonia; *x*-ray diagnosis influenza, confirmed by final diagnosis . 3
5. Clinical diagnosis influenza; *x*-ray diagnosis bronchopneumonia, confirmed by final diagnosis . 15
6. Clinical diagnosis influenza; *x*-ray diagnosis lobar pneumonia, confirmed by final diagnosis . 1
7. Clinical diagnosis not determined; *x*-ray diagnosis congestion, bronchitis; final diagnosis congestion, influenza 1
8. Clinical diagnosis influenza confirmed by final diagnosis; *x*-ray diagnosis negative 1
9. Clinical diagnosis bronchopneumonia confirmed by final diagnosis; *x*-ray diagnosis probable lobar pneumonia 1
10. Clinical and *x*-ray diagnosis influenza; final diagnosis bronchopneumonia 12
11. Clinical diagnosis influenza; *x*-ray diagnosis probable pulmonary tuberculosis; final diagnosis congestion, influenza, tuberculosis 1
12. Clinical diagnosis influenza; *x*-ray diagnosis fluid; final diagnosis pneumonia (probable bronchopneumonia) 1
13. Clinical diagnosis questionable; *x*-ray diagnosis positive; final diagnosis positive:
    Clinical diag.—Questionable pneumonia
    X-ray diag. bronchopneumonia, confirmed by final diagnosis 3
    X-ray diag. influenza, confirmed by final diagnosis 1
    X-ray diag. influenza; final diagnosis bronchopneumonia 1
14. *X*-ray diagnosis questionable bronchopneumonia, confirmed by final diagnosis; clinical diagnosis influenza 4
15. *X*-ray diagnosis questionable bronchopneumonia; clinical diagnosis bronchopneumonia; final diagnosis confirming 1
16. *X*-ray diagnosis questionable pneumonia; clinical diagnosis influenza; final diagnosis bronchopneumonia 1
17. *X*-ray diagnosis questionable influenza; clinical diagnosis influenza; final diagnosis influenza . . 1

Total 83

Radiological Changes (includes all groups).

Lung Density.

Right 18: br. pn. 12; infl. 6
Left 18: br. pn. 15; infl. 2; lobar pn. 1
Both 33: br. pn. 27; infl. 6
— 20

Upper only 3: br. pn. 3
Middle only 8: br. pn. 7; infl. 1
Lower only 26: br. pn. 17; infl. 9
Upper and lower 3: br. pn. 3
Upper and middle 5: br. pn. 4; infl. 1
Middle and lower 15: br. pn. 15
Upper, middle and lower 8: br. pn. 6; infl. 1, lobar 1
— 21

Congestion.

General congestion in all but 6 cases—br. pn. 2; infl. 4. (All six cases showed local congestion)
Local congestion in all but 17 cases—br. pn. 8; infl. 9 (All seventeen cases showed general congestion)
Lobular. 41: br. pn. 36; infl. 5; questionable 15; br. pn. 7; infl. 6; lobar 1
Lobar. 27: br. pn. 24; infl. 3; questionable 1; lobar
Bronchial. All but 13: br. pn. 9; infl. 3; questionable 1; lobar

Hilus Density

Right 10: br. pn. 4; infl. 6
Left 1: br. pn. 1
Both 78: br. pn. 51; infl. 25; lobar 1
Middle and lower 22: br. pn. 16; infl. 6
Upper, middle, lower 66: br. pn. 40; infl. 25; lobar 1
Upper and lower 1: br. pn. 1

Enlarged in every case but 4. In these four cases only slight enlargement: br. pn. 2, infl. 2.
Congested in every case but 4. Congestion slight in these four cases: br. pn. 2, infl. 2.
Outline.
Well defined 18: br. pn. 8; infl. 10
Fair 38: br. pn. 23; infl. 14; lobar 1
Ill defined 34: br. pn. 28; infl. 6

Mediastinum.

Increased in density in every case.
Enlarged, broadened in all but three cases, where it was slightly enlarged: br. pn. 1; infl. 2

Diaphragm.

Dome-shaped in all but 14 cases. Of these 3 were slightly dome-shape: br. pn. 2; infl. 1
Dome-shape on rt. 2: br. pn. 1; infl. 1
Flat 9: br. 4; infl. 5
Flat 58: br. pn. 36; infl. 21; lobar 1.
Flat on the left only, 2: br. pn. 1; infl. 1.
Irregular 13: br. pn. 10; infl. 3.

Heart. Rt. auricle dilated in all but 23 cases, of which 2 were negative (infl. 2); 1 showed moderate enlargement (br. pn. 1); 19 showed slight enlargement (br. pn. 13; infl. 6) and 1 was questionable (br. pn. 1).
Left pulmonic area dilated in 66 cases: br. pn. 44; infl. 21; lobar 1.
Moderate dil. 2: br. pn. 2
Slight dil. 18: br. pn. 10; infl. 8
No dil. 3: br. pn. 1; infl. 2
Left ventricle dilated in 30 cases: br. pn. 25; infl. 5.
Moderate dil. 1: br. pn. 1
Slight dil. 14: br. pn. 10; infl. 4
No dil. 43: br. pn. 19; infl. 23; lobar 1
Questionable 1: infl. 1
Aorta dilated in 62 cases: br. pn. 41; infl. 20; lobar 1.
Moderate dil. 2: br. pn. 1; infl. 1
Slight dil. 17: br. pn. 9; infl. 8
No dil. 8: br. pn. 5; infl. 3

Progress of Disease Radiologically in Pneumonias and Bronchopneumonias (includes all groups).

Onset	*Progress*	
Both hila to both bases		9
	left base	2
	right base	1
	both middle	3
	left upper and middle and rt. lower	2
	left middle	2
	left middle and rt. lower	1
	left middle and rt. upper	3
	left lower and rt. middle	1
	right base and left middle	1
	right base and left middle and base	1
	right middle and upper and left middle	1
	No extension	1
Right hilus to base		5
	middle and lower	1
	middle	2
	upper	2
	left middle and upper	1
	right upper and left middle	2
Left hilus to base		1
	base and middle	3
	middle, upper and lower	1
	middle	4
Right base to right middle and upper		1
	left hilus and middle	1
	right middle and left lower	1
	No extension	1

Right middle to right upper and lower 1
Right lung, base to apex to left base 1
Left lower to right lower and middle 1
Left upper and lower right and left upper, middle and lower 1
Left middle to left upper and right upper 1

Corps Men, Officers and Nurses. Physical and Radiological Signs Compared.

Average *Age* 32.

Clinical Signs.
Severe 8: br. pn. 5; infl. 3.
Moderate 31: br. pn. 25; infl. 5; lobar 1.
Mild 33: br. pn. 15; infl. 18.

Radiological Exam.
Marked changes 36: br. pn. 33; infl. 1; lob. 2.
Slight changes 38: br. pn. 14; infl. 24.

Clinical Changes.
Breathing, br. 17: br. pn. 15; infl. 1; lob. 1.
Bron. vesc. 13: br. pn. 19; infl. 2.
Harsh 14: br. pn. 10; infl. 3; lob. 1.
Feeble 7: br. pn. 7.
Dimin., distant 17: br. pn. 11; infl. 6.
Negative 18: br. pn. 6; infl. 12.

Râles.
Crep. 30: br. pn. 25; infl. 4; lob. 1.
Subcrep. 30: br. pn. 20; infl. 9; lob. 1.
Indetermin. 30: br. pn. 23; infl. 5; lob. 2.
All kinds 2: br. pn. 2.
Fine râles 2: br. pn. 2.
Coarse râles 1: br. pn. 1.
None 8: br. pn. 2; infl. 6.

Fremitus.
Increased 42: br. pn. 30; infl. 10; lob. 2.
Dimin., impaired 3: br. pn. 3.
Pectoriloquy 1: br. pn. 1.
Negative 28: br. pn. 14; infl. 14.

Dullness 57: br. pn. 42; infl. 13; lob. 2.
Negative 17: br. pn. 6; infl. 11.

Heart Dilated 5: br. pn. 4; infl. 1.

X-ray signs preceding clinical signs, 2 cases, 1 by 3 days; 1 by 6 days.

Corps Men, Officers and Nurses. Physical and Radiological Signs Compared.

Temperature

Lowest Point	96°	21	Highest Point	106°	1
	97°	36		105°	5
	98°	4		104°	24
Above	99°	9		103°	21
Unknown		4	Below	102°	20
			Unknown		3

Pulse

Lowest Point	42	1	Highest Point	160	2
	48	1		152	3
	50	2		136	1
	52	6		132	1
	54	2		128	2
	56	6		124	1
Above	60 to 96	50	Below	120 to 96	53

Respiration

Lowest Point	14	3	Highest Point	80	1
	16	11		64	3
	18	43		60	1
Above	20 to 26	14		58	1
				56	3
			Below	52 to 26	62

Tuberculosis Cases. Physical and Radiological Signs Compared

Average *Age* 25.
Clinical Signs.
Severe 3: br. pn. 3.
Moderate 7: br. pn. 4; infl. 1; lob. 2.
Mild 5: br. pn. 2; infl. 2; lob. 1.
Radiological Exam.
Marked changes 9: br. pn. 7; lob. 2.
Slight changes 6: br. pn. 2; infl. 3; lob. 1.
Clinical Changes.
Bron. *breathing* 3: br. pn. 3.
Bron. vesc. *breathing* 2: br. pn. 1; pn. 1.
Harsh *breathing* 2: br. pn.2.
All kinds 1: lob. 1.
Râles.
Crepitant 4: br. pn. 3; pn. 1.
Subcrepitant 3: br. pn. 3.
Bubbling 2: br. pn. 2.
Indetermiate 1: infl. 1.
All kinds 3: br. pn. 1; pn. 2.
None 2: infl. 2.
Fremitus.
Increased 3: br. pn. 2; lob. 1.
Dullness 10: br. pn. 7; lob. 3.

Temperature

Lowest Point	96°	2	Highest Point	100°	7
	97°	2		103°	5
	98°	5		102°	2
	99°	4		100°	1
	101°	1			

Respiration

Lowest Point	14	1	Highest Point	60	1
	16	2		48	1
	18	5	Below	40 to 24	13
	20	6			
	22	1			

Pulse

Lowest Point	45	1	Highest Point	146	1
	56	1		140	1
Above	60 to 100	13		126	1
			Below	120 to 100	11

Number of cases in which radiological diagnosis of bronchopneumonia was made upon first examination 6
Lobar pneumonia 4
Influenza 5
Final radiological diagnosis of bronchopneumonia 9
Lobar pneumonia 3
Influenza 3

Radiological Signs

The author takes this opportunity to acknowledge his indebtedness to Lieutenant Edward I. Liss for his very valuable assistance and to express his thanks for the efforts of the *x*-ray staff.

COMPLICATIONS OF INFLUENZA FROM THE ROENTGENOLOGICAL STANDPOINT*

BY RUSSELL H. BOGGS, P. A. SURG., U. S. N.

PITTSBURGH, PA.

THE complications of influenza were studied by the roentgen rays at the United States Naval Hospital, Philadelphia, all the plates being taken stereoscopically with a few exceptions when the patients were too sick to be moved. The plates were studied in conjunction with the various staff officers, and the shadows shown were accounted for clinically, by operation or autopsy. Many of the patients were examined repeatedly, which made the series of cases examined extremely interesting. The picture of the pneumonic process was a lobular bronchopneumonia and appeared anatomically usually in a disseminated form. The foci were very near together and confluent in certain parts of the lungs, and in others obscure and far apart. The stereoscopic picture showed the image to be made up of a series of distinct shadows more or less confluent, and in most cases separated one from another by clear spaces. In some cases the appearance of certain forms of chronic tuberculosis was simulated.

It is evident that an influenza bronchopneumonia may give a stereoscopic picture analogous to certain forms of tuberculosis, and that it is only by care and by knowing the clinical side of the case that the true nature of the pulmonary process may be ascertained. When examined by a single roentgenogram in these influenza pneumonias one would be impressed that the lung cast a rather dense shadow in certain regions; but when a stereoscopic pair of plates were examined the apparent densities seen on a single plate were shown to be caused by added shadows throughout the lung tissue, and this was the reason that in so many cases so little was obtained by percussion. After studying a series of cases by the roentgen rays it was interesting to note the accuracy with which we could tell the kind of breathing the lung densities would produce, namely, bronchial, bronchovesicular, etc.

The influenza chest of a very sick patient would usually give a rather characteristic picture. The glands varied in size from a grain of shot to a pea or even larger, and had a clear cut edge, as though each was injected with a rather dense material. This, together with prominent hilus shadows and increased linear markings of the lung fields, was called an influenza chest. If the glands were very prominent with some confluent areas of consolidation, the patient was always found to be very sick. The differences in the linear markings from those found in the tuberculous lung were that they were more general, and usually found in both lungs. These lines continue plus for some time after influenza, and a differential diagnosis from tuberculosis is going to be extremely difficult. This is bound to be a source of error during the next two or three months. Some of these influenza chests, having prominent linear markings, have been examined repeatedly since their recovery, and the plates showed that these markings were slow in disappearing. Influenza frequently caused the so-called fan-shaped markings described by Dunham, which are supposed to be diagnostic of tuberculosis. Influenza seemed to make a tuberculous process more active, this being particularly true in latent cases. Thickened pleura or effusions are clearly shown roentgenologically. The layers of the pleura are only visible in the pathological state when inflammation has produced a thickened pleura or a serofibrinous deposit on its walls.

During the recent influenza epidemic large pleural effusions were not very common, but small collections of circumscribed effusions or thickened pleura were frequently

* Read at the Midwinter Meeting of the American Roentgen Ray Society.

seen. The large pleural effusions presented the usual roentgen ray findings and offered no difficulty in interpretation. There were a few instances in which extensive thickened pleura with a plastic exudate of the lower lobe simulated a large pleural effusion roentgenologically, except that there was no displacement of the heart or change of level of the density with position. The diaphragm shadow was lost, and it was fixed by pleural adhesions. To confuse further findings, often a partly solidified lung was present. Then the differential diagnosis required all the skill of the internist and the roentgenologist. Several such cases were confusing to all, and in one case in particular the patient was not referred to the roentgen ray laboratory until his temperature was running a normal course.

In many of these thickened pleuras, with a small amount of effusion, the temperature was the most diagnostic clinical symptom, because the patients' degree of sickness was too acute to be accounted for by the physical findings alone. By hasty interpretation in many of these cases, a large pleural effusion would have been diagnosed when only thickened pleura with an aplastic exudate was the cause of the extensive shadow. As a rule, the diagnosis of pleural effusions belongs to the clinician and is only confirmed by the roentgen ray. However, under certain circumstances the roentgen method plays an important part, not only in the diagnosis but also in determining the treatment that is advisable. The pleura effusion may be of small amount, but associated with more or less pulmonary consolidation. This will modify considerably the physical findings as well as the roentgen image.

After pneumonia, sometimes the temperature returns and the symptoms are aggravated. Then the question arises whether it is a pneumonic process with slow resolution and the symptoms aggravated, or whether it is pleurisy. The clinician is often unable to state what positively exists, and auscultation reveals such miscellaneous pleural and pulmonary signs that they are difficult to interpret. Some dullness persists and it is almost impossible to draw positive conclusions. The question of interlobular or a circumscribed pleurisy arises, and the roentgen study carefully considered with the clinical symptoms has been found to be of extreme value. Here the interpretation of the plate is not easy, and the roentgenologist must be a physician and one who can interpret his findings in conjunction with the clinical findings presented by the internist. In fact, the roentgenological examination is not conclusive, but it is necessary to interpret what is seen and draw conclusions for a useful diagnosis. The difficulty of interpreting chest plates demands an accurate knowledge of anatomy, physiology and pathology, and consequently cannot be done by anyone but a physician who knows the normal, and knows what abnormal shadows are cast by the various pathological lesions. Roentgenology has become a science; but there is need of greater collaboration between the physician and the roentgenologist.

As before stated, the clinical diagnosis of circumscribed pleurisy is difficult clinically; and the roentgen method, therefore, becomes of the greatest use in detecting small effusions. But it is not limited to that alone, because many of these small purulent effusions need immediate intervention. The exact location of the effusion can be determined, and the plates will show from what point it should be approached. The roentgen image of interlobar pleurisy with effusion is quite characteristic, consisting of a traverse band which entirely crosses the pulmonary field and divides the lung into three zones. If the pleural effusion is limited to the interlobar space and is slight, the respiratory movements of the diaphragm may be only slightly interfered with. Interlobar pleurisy with effusion was found to be rare; the circumscribed was more common, and often found in the axillary region.

In studying the chest of these influenza cases, I was struck very forcibly by the

fact that we really had no standard normal lung roentgenogram any more than we had a standard normal roentgenogram of the stomach. It is well known that an examination of healthy individuals without any lung infection of any type will reveal a widely different picture as to the character and thickness of the bronchial trees and also a vast difference in the general density of the lung fields. Therefore, before we are able to interpret chest findings roentgenologically, we must always study the history of the case and know what changes have occurred in the lungs prior to the condition under examination. This study should include the various diseases that the patient may have had, and the changes due to inhalation of various particles of dust, such as results from patients having worked in mines or in cement works, or even from having lived in some cities.

Again, the study of a series of chest plates of healthy individuals, without any history of disease whatever, and who have lived under favorable conditions, will show that the hilus and parenchyma vary considerably. The diagnosis of tuberculosis is always considered in the study of any chest, since a patient may have had a latent affection without any history of the disease. A study of the various changes of the lungs which are likely to take place during life without the history of any pulmonary disease, or of those which are so minor as to escape detection must be carefully considered. We all know that the bronchial tree and the lung fields give a different appearance in a healthy child five or ten years of age as compared with a person of sixty or seventy years of age, depending on many conditions. Possibly the lungs might be compared to the skin, which in childhood is firm and elastic, and in old people wrinkled, atrophic, etc., both conditions being normal for the individual.

In conclusion, the roentgen rays as a means of diagnosing and recording the changes in the lungs and pleura are not directly diagnostic; but when compared with inspection, palpation, percussion and auscultation they yield much more accurate information than can be obtained by physical signs alone. It is a more accurate method than percussion alone, because even deep percussion is not accurate more than two and one-half inches below the surface, and the density in the lungs and pleura can be better compared with the normal and surrounding or adjacent organs and tissue. Stereoscopic plates taken anteriorly and posteriorly show the density and thickness of a pneumonic lung or a layer of fluid in the pleural cavity. By knowing the thickness and density of the pathologic lesion in the lung or pleura, or both together, with its position, one can usually tell what kind of breathing is heard by the stethoscope. The fluoroscope is a valuable aid to the roentgenologist for chest examinations in showing that much of the function of the lungs is disturbed by the pulmonary disease; but it cannot take the place of a good pair of stereoscopic plates taken posteriorly and anteriorly.

The value of taking plates stereoscopically, both anteriorly and posteriorly, must not be neglected, because an image of density nearest the plate is always copied the most accurately and distinctly. By taking anterior and posterior plates, we are able to determine the situation of the lesion, which could not be done by anterior or posterior plates alone. It therefore follows that one who makes his diagnosis by the fluoroscope alone is never making a complete examination of the chest by roentgenology. Less dependence should be placed on a fluoroscope and more on stereoscopic plates taken anterior-posteriorly and posterior-anteriorly. Unfortunately, we have strong advocates of both methods, whereas the fact is that it is only by a combination of both, together with a complete history, observation of symptoms, familiarity with different forms of lung pathology, and by careful physical examination, that a diagnosis should be

made. Without these a diagnosis should never be attempted. At present, in a great many institutions, the history taking and the roentgen ray examinations are usually left to the inexperienced. The most important and the most difficult thing to obtain in chest examinations, in the past, has been team work. A physical diagnostician may excel by his own method just as a roentgenologist of experience and judgment will in his, or as the older physician will in inspection or personal history taking; but this will not compensate for lack of team work.

At the United States Naval Hospital, Philadelphia, it was the excellent team work instituted by Dr. W. A. Angwin and carried out by the various ward officers and heads of the laboratories, in conjunction with consultants, Drs. Hare, DeLand, DeCosta and Pancoast, that produced such satisfactory and splendid results.

WINGED AMBULANCES OF THE UNITED STATES ARMY

Following the example of certain of the European armies, the United States Army has of late been experimenting with an aerial ambulance with the object of evolving a rapid and convenient means of transporting severely wounded soldiers from the battlefield to the base hospital.

The American winged ambulance is a modified Curtiss two-seater biplane, arranged with a removable top section in the fuselage, just back of the pilot's seat. The removable panel permits of readily placing the litter with its human freight into the airplane body; whereupon the panel is replaced so as to protect the wounded man from the cold and wind. The airplane, in this case, is painted white and marked with conspicuous red crosses so as to distinguish it from fighting craft.

In the latest forms of French flying ambulances the equipment is quite complete. Among the things carried are portable stoves, a complete *x*-ray outfit operating from a generator on the airplane, the necessary surgical instruments and supplies, and a simple tent. However, the French have been working on the problem of flying ambulances for upward of two years, and are therefore further along with the matter than we are at present.—*Scientific American*, Vol. CXIX, No. 23.

THE CALDWELL PORTABLE ROENTGEN RAY OUTFIT

BY C. N. MOORE

SCHENECTADY, N. Y.

THE need of a portable roentgen ray outfit which can be taken to the bedside in emergency cases has long been felt by the roentgenologist. Dr. Caldwell, with his characteristic skill and ingenuity, built up in his laboratory a simple, light-weight, reliable coil outfit of sufficient capacity for this purpose. The following is a brief description of the outfit as he had been using it for some time in his general practice.

General Description. — The apparatus consists esssentially of three units, as shown in the accompanying photographs; namely, an induction coil with attached tube holder and tube, an instrument box, and a mercury turbine interrupter. The necessary wires for connecting the various units together complete the outfit. Each unit is compactly assembled and is of such a weight that it can be conveniently carried by the handle provided. The connecting wires are provided with suitable plugs so that the complete outfit can be very quickly and correctly assembled ready for use.

Induction Coil.—The induction coil (Fig. 1) is mounted vertically in a wooden case 10 inches square and 18¾ inches high. This case is provided with a cover, divided in the center and hinged at each side, which is opened when the coil is in use. Mounted on the covers are series spark gaps and reels for the high-tension circuit. The opening between series spark gaps can be adjusted by means of hard-rubber levers pivoted on the cover.

The high-tension leads from the coil are brought up through a hard-rubber partition in the top of the case by means of suitable bushings located in diagonally opposite corners. Permanent connections are made from the tops of the bushings to the series gaps and thence to the reels and to a parallel spark gap, which is mounted on two hard-rubber posts and which is controlled by means of a hard-rubber rod with a knurled head. Milliammeter leads from the middle of the secondary winding of the coil, together with the low-tension leads, are brought up through a bushing in one corner of the top of the case. Both milliammeter and low-tension leads are provided with a common terminal block

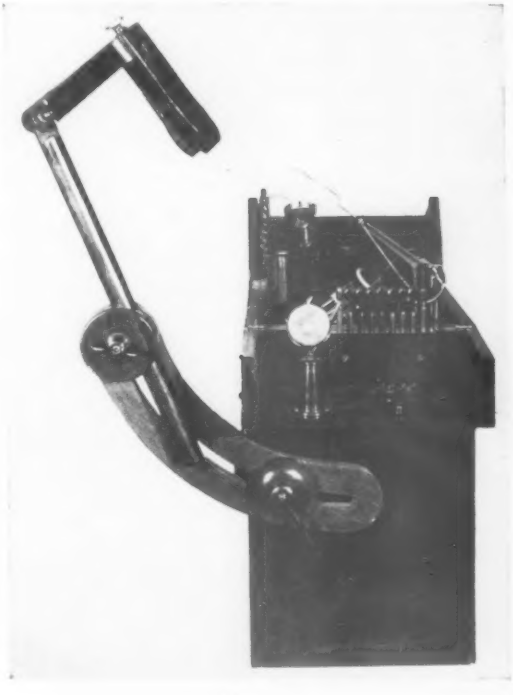


FIG. 1.

through which connections are made with the instrument box. All of these various devices are so arranged that the cover can be closed without their interfering with one another.

The tube holder is fastened to the side of the case and consists of a wooden arm with three friction joints, which make it possible to locate the tube in any desired position. It provides for an overhang of 34 inches in

the extreme position, and folds compactly at the side of the case when not in use.

The total weight of the coil, case, and tube holder is 52 pounds. A heavy strap fastened to the sides of the case is provided for carrying the unit.

The tube used with the outfit is a small Piffard gas tube made by Machlett & Co.

Instrument Box.—The instrument box (Fig. 2) consists of a wooden case 9 inches wide, 16 inches long and 6½ inches high, provided with a hinged cover and a suitable handle. Mounted on a hard-rubber panel inside the case are the various meters, switches, attaching plugs, etc., necessary for the operation of the coil and interrupter. The meters consist of a D.C. voltmeter for measuring the line voltage, a milliammeter for measuring the current through the tube, and a D.C. ammeter for measuring the current in the primary of the induction coil. Connections to the supply line, to the motor of the interrupter, to the interrupter, and to a hand switch are made at the four attaching plugs at the bottom of the panel, and to the coil at the terminal block above the milliammeter. A push button switch for operating the interrupter motor is located on the panel; also a fuse plug in the main line circuit. A condenser connected in parallel with the primary of the induction coil is placed in the box under the panel.

The instrument case complete weighs about 22 pounds.

Interrupter.—The interrupter (Fig. 3) used is a Sanax mercury turbine with kerosene dielectric. It is suspended from a light-weight wooden framework so that it swings freely in a vertical position and

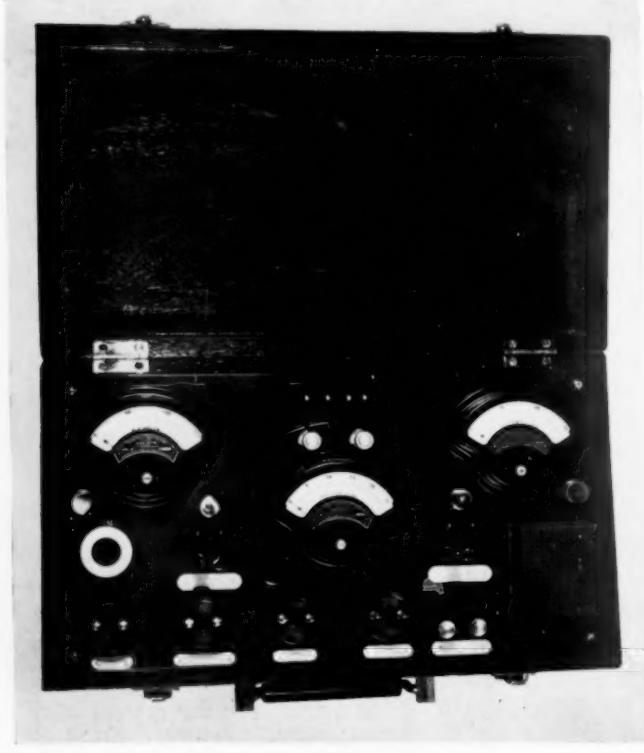


FIG. 2.

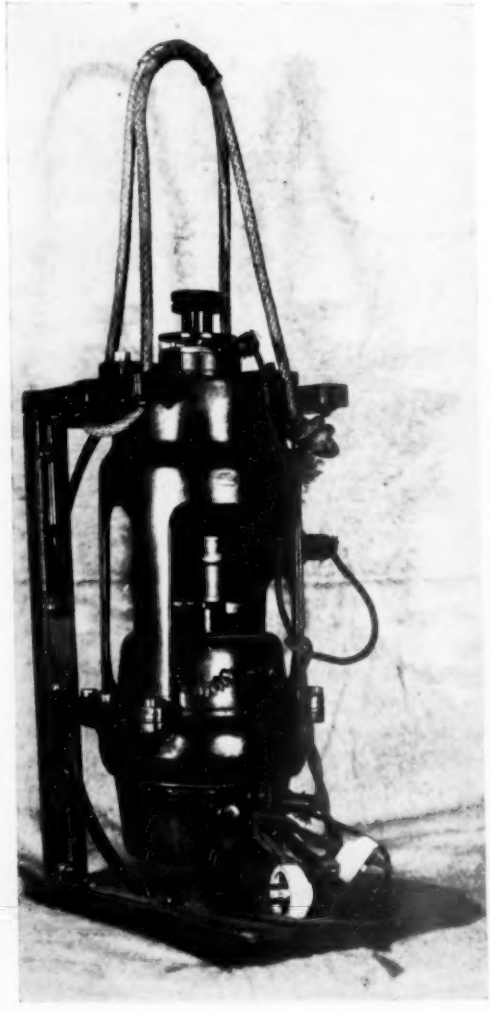


FIG. 3.

runs very quietly. The unit weighs 34 pounds and is carried by means of a rope handle.

Assembly.—The outfit as assembled for use is shown in Fig. 4. The induction coil is placed upon a chair or suitable bench at the bedside and the instrument box and coil in some convenient position nearby. A plate-changing tunnel (Fig. 5) is usually used for holding the plate in the envelope or cassette.

Carrying Case.—For transporting the complete outfit to the bedside, the tube is placed in a felt-lined wooden case, and this, together with the instrument box, connecting wires, plates, etc., is packed in one large carrying case (Fig. 6), 27 inches long, 10½ inches wide and 19 inches high. The coil and the interrupter are carried separately.

Operation.—The outfit is intended to be operated on about 115 volts D.C., and under these conditions will give 10 milliamperes at about a 4½-inch parallel spark

Fig. 4.

gap, drawing about 7 amperes from the line.

Field of Usefulness.—By the use of this apparatus one can secure very satisfactory plates of any part of the body. Perhaps its greatest field of usefulness has been in fractures and in lung examinations. Very satisfactory lung plates may be obtained in five to eight seconds at a plate target distance of 30 inches, while a lateral of the knee may be secured in about two to five seconds.

Examinations of the mastoid cells and of the accessory nasal sinuses have been successfully undertaken, and shadows of kidney stones and gall stones have also been demonstrated by its use.

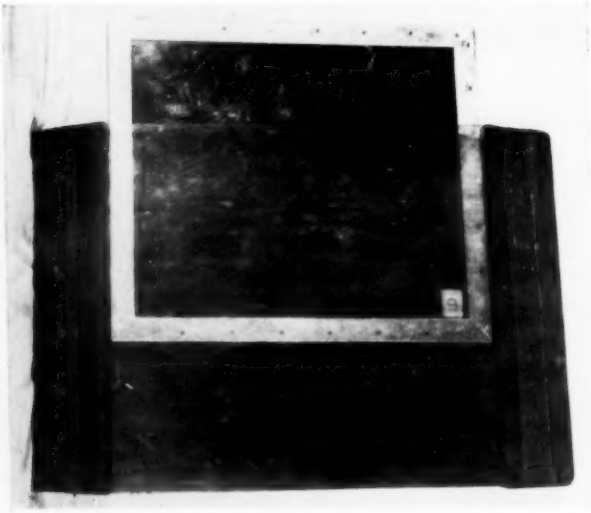


FIG. 5.

FIG. 6.

SUPERFICIAL EPITHELIOMAS

De Rezende calls attention anew to the excellent results he has obtained in treatment of epitheliomas of the skin with a salve which penetrates rapidly into the tissues and requires no dressing to hold it in place. In five cases during the last three years the epithelioma of from three to six years' standing was completely cured with one or two applications a week, first removing crusts and dead tissue, and suspending the applications if the tissues around become inflamed. Illustrations are given of some of the cases. The formula calls for 0.20 gm. each of arsenious acid, copper sulphate, methylene blue and methyl violet; with 0.50 gm. quinin hydrochloride; 0.75 gm. tartar emetic, and 1 gm. each of camphor, menthol, phenol and antipyrin. The last four ingredients are mixed together first. They deliquesce and form the vehicle for the other ingredients which are added in turn, leaving the methylene blue and methyl violet till the last. He describes the special function expected of each of these ingredients.—*J. Am. M. Ass.*, Nov., 1918. Cur. Med. Lit.

THE AMERICAN JOURNAL OF ROENTGENOLOGY

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THE FUTURE OF RADIUM

In every article or substance in the universe three stages have to be distinguished: past, present and future. But the world is confronted with the task of investigating and defining what the past, present and future stages have been, are or will be. The present uses and qualities of an article or substance are more or less a matter of ocular or physical demonstration; their past can generally be investigated with a fair amount of satisfaction; and the future, while always speculative, can be fairly prognosticated based on present and past performances.

Radium makes an exception in this as well as in other vital respects. In spite of the light it sheds, both physically and mentally, it leaves us in the dark as to its past, present and future stages. In the consideration of any proposition the present stage is always the most tangible; it is the pivotal center from which to work in all directions, backward and forward, and from the explorative information thus gained further conclusions are justified, increasing the knowledge of the world.

As adepts of the healing art, we are principally concerned in the present stage of radium, and it must be confessed that the opinions of accepted authorities differ widely, ranging as they do from unbounded enthusiasm to the rankest pessimism. He who contents himself with the philosophical attitude that the truth will probably lie somewhere between, may be satisfied with allowing things to take the even tenor of their way, accepting whatever good or bad Nature may have in store for us.

Not so the true scientist. While enthusiasm is a prerequisite in the successful performance of arduous researches, it should not be one-sided or biased either in favor or condemnation of the subject to be investigated. The successful investigator must be broadminded and have his physical and mental eyes wide open. The skilful surgeon is apt to place the efficiency of the knife in accessible cancer above the curative, palliative or destructive action of radium; he is at pains to find fault with radioactivity—not because he thinks that radioactivity is no good but because he thinks that surgery is better. He exemplifies the type of whom it may be said, "Once a surgeon, always a surgeon." Such an attitude is not scientifically justified, and the same holds good for the opposite

extreme. Radium enthusiasts claim successes which, although unquestionably true in certain cases, are not sufficiently uniform to be accepted as an equivalent or superior substitute for surgery in all similar cases as a routine proceeding.

These considerations go to show that the present stage of radium, our knowledge of what radium is and what it can accomplish, is still insufficiently explored. A systematic compilation of scientifically sifted facts and figures would help in establishing at least a basis upon which further scientific deductions can be carried on.

At a recent address, delivered before the Astronomical Society of Los Angeles (*Radium, May, 1917*) Willett L. Hardin expressed this task in the following words: "When we consider the new and unexplored world which radioactivity has revealed, the intimate knowledge it has given us of the constitution of matter, the possible influence of radioactive substances in geologic and cosmic phenomena, the possibilities which the vast stores of energy have suggested and the influence of radioactive rays on the vital functions of the living cell, it is impossible to say what part radioactivity may have played and is playing in the economy of Nature."

Thus, there are infinite possibilities in store for us, so far as the future of radium is concerned, and from this standpoint it is worse than useless to try to lay down definite axioms, for instance, for or against the curability of cancer by radium with nothing better to guide us than the comparatively meager attainments in the present stage of our knowledge.

The daily press is one of the worst offenders in this respect. The members of the "fourth estate" are apt to exaggerate, and this refers with more than usual force to their handling of so mysterious a substance as radium. It matters little to them whether the "news" they print damn or praise a new science, as long as it is sensational. This undesirable feature was well illustrated in the case of the radium report issued in 1916 by Dr. F. C. Wood as head of the Crocker Cancer Research Fund, which was distorted in the daily press of almost the entire country as showing radium to be a failure in the cure of cancer.

Even while in the present stage of our knowledge and technical achievements radium has not been exploited to the full extent of its possibilities, those investigators who have gone most deeply into the subject hold out the brightest hopes for the future. This conviction is expressed by Hardin in the following words:

"Radio-activity has revealed the fact that the atom is a great storehouse of energy. What influence this discovery may exert upon the human race remains for the future to determine. Realizing that human life is so intimately dependent upon an adequate supply of energy, it is interesting to contemplate the result of being able to control and utilize the potential energy of the atom. It would probably cause more radical changes in our customs and habits than any combination of social and political influences could produce. It would make us independent of heat and cold, of drought and flood, and it would enable us to 'transform a desert continent and thaw the frozen poles.' "

Soddy goes a step farther. He considers it possible that radio-activity, including atomic transformation, is competent to be the mainspring of the universe. If such should prove to be true, with all the consequences contingent upon that knowledge, the radium cure of cancer, reasonably speaking, should become as easy a matter as the opening of a rose bud under the influence of the sun.

CORRESPONDENCE

ROENTGEN SOCIETY.

33 Newton Street,
High Holborn, W.C. 2, England.

25th February, 1919.

The Editor,
The American Journal of Roentgenology,
67–69 East 59th Street,
New York.

DEAR SIR:

As a corresponding Member of the American Roentgen Society I was most interested in the article on the Caldwell Stereo fluoroscope appearing in your December number, and this was particularly engaging to me, as it deals with an instrument which has been worked out in this country to perform the same purpose, although the method by which it is obtained is somewhat different.

The Stereo fluoroscope to which I refer has one advantage over the Dr. Caldwell instrument, as it does not require alternating current or special motors of any kind. It will work just as easily from an interrupterless high tension rectifier as from an ordinary induction coil with interrupter, and is provisionally protected.

My reason, however, in writing was not to refer to this but to draw attention to the diagram on page 548 which surely is not quite correct.

The image which is cast by the tube F1 in that diagram should surely be viewed by the eye E1 and the image which is cast by the anti-cathode F2 should be viewed by the eye E2.

This is conveyed by the text; but curiously enough the diagram is in error in making the lines of vision cross over between the eyes and the shadow on the screen. The lines from the screen F2 should have been produced to E2 not to E1.

This diagram may be somewhat misleading to those who have not studied stereoscopic vision, and that must be my sole excuse in referring to it.

Perhaps the whole principle of stereoscopic vision will be explained very much more simply by the enclosed diagram.

Figure 1 shows a solid object viewed by two eyes, the left eye observing the front and the side while the right eye sees only the front.

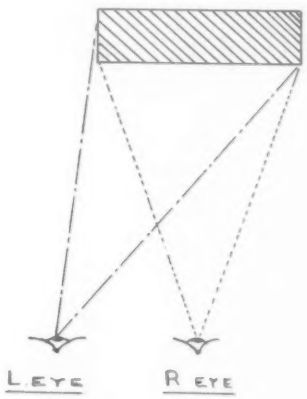
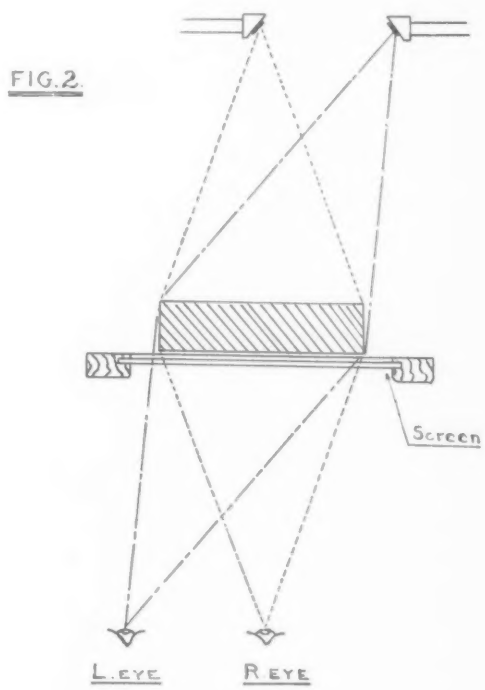


FIG. 1.

Figure 2 shows the same diagram but with a fluorescent screen interposed between the eyes and the object of each; a shadow will have to be cast similar to that in the lines of vision shown.



This can obviously only be done by tubes in a corresponding position, and the diagram will clearly show that the image projected by the right tube must be seen by the left eye, if a true stereoscopic effect is to be obtained, otherwise the effect is pseudo-stereoscopic, which means that the whole of the relief is reversed.

Yours truly,

GEOFFREY PEARCE,

Hon. Treasurer.

New York City, April 7, 1919.

The Editor,

The American Journal of Roentgenology.

DEAR SIR:

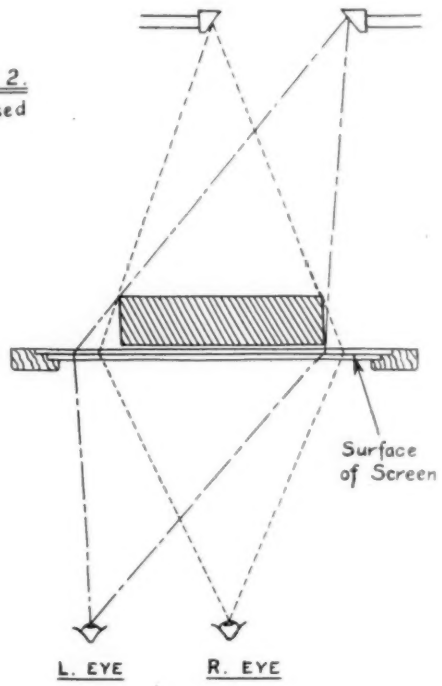
The diagram on page 548 unfortunately does not agree with the text, inasmuch as it shows the shutter in proper phase for pseudoscopic rather than true stereoscopic vision. However, this is fully as useful as true stereoscopic vision in many instances, and it is especially valuable in the localization of foreign bodies. The change may be instantly made from one type of vision to the other at the will of the operator by throwing a pole changing switch in the transformer primary circuit.

Fig. 2 of Dr. Pearce's explanation is hardly in accordance with the facts, since the observer sees only the screen image and not the object behind the screen. This diagram is shown herewith in a revised form.

Very truly yours,

LIVINGSTON MIDDLEDITCH, JR.

FIG. 2.
Revised



NOTICE OF ANNUAL MEETING

The Twentieth Annual Meeting of the American Roentgen Ray Society will be held in Saratoga Springs, New York, Wednesday to Saturday, September 3rd, 4th, 5th and 6th. Several features of the program have been decided and others are under consideration. One afternoon will be spent in the Research Laboratory of the General Electric Company at Schenectady, the Society being the guest of Dr. W. D. Coolidge. It is hoped to give another afternoon to recreation; the vicinity of Saratoga Springs abounding in points of natural beauty and historic interest. There will be a banquet on one evening to which the visiting ladies will be welcomed. Another evening will be given to the lantern slide demonstration of case reports. It is hoped that we may also devote a part of one session to the lantern slide demonstration of laboratory devices and similar items of technical import.

The headquarters of the Society will be at the Grand Union Hotel, and it is suggested that early reservation be made by those who expect to attend the meeting. Special rates have been obtained for members of the Society.

RESOLUTIONS ADOPTED BY THE PACIFIC COAST ROENTGEN RAY SOCIETY

RESOLVED:

1. That the practice of roentgenology is an important branch of medicine and surgery and should be recognized as such.

2. As a special branch of medicine and surgery its practice should be confined to those qualified by education and experience, viz., by licensed practitioners of medicine and dentistry.

3. That the California State Medical Society should act with the State Dental Society to legally establish the status of roentgenology by introducing into the legislature such additions to our laws as may be necessary.

4. That persons who are not licensed physicians or dentists be allowed to act as roentgen technicians in hospitals or in offices of physicians or dentists only after examination and licensing by the respective Board of State Medical and Dental Examiners and that it shall be unlawful for such technicians to render roentgen diagnosis or interpretations.

ANNUAL MEETING OF THE AMERICAN RADIUM SOCIETY

The next annual meeting of the American Radium Society will be held at Atlantic City, New Jersey, Monday, June 9th, at the Seaside House.

DR. HENRY K. PANCOAST,

Secretary.

TRANSLATIONS & ABSTRACTS

EGGERS, CARL. Empyema—Analysis of 70 Cases at Base Hospital, Camp Jackson, S. C. (*Surg., Gyn. & Obst.*, April, 1919.)

The clinical types and surgical treatment of empyema are discussed at length. In discussing the diagnosis he states that:

"Though according to text books the detection of fluid in the thoracic cavity should be quite easy, it is by no means always that. It is by the careful examination of the chest, done daily and recorded on the chart that the presence of fluid is first suspected. By this systematic work, the variation in signs from the previous day or days will be noted. Displacements of the heart are of great value. By having had the patient under observation for some time, one is familiar with the organism causing the infection and can be on the lookout. It is important that the presence of large amounts of fluid be detected early and that it be submitted to bacteriological examination, because one is guided in the treatment largely by the laboratory findings. It is interesting with what rapidity the fluid sometimes develops. However, at times all physical signs fail, and it is familiar to those who do much of this work how deceptive signs may be. It is probably not putting it too strongly when we state that fluid in the chest may give the exact physical signs of a pneumonia and vice versa. Therefore, when a suspicion of fluid exists, whether early in the disease or because the lung condition does not clear up as promptly as it should, one should never hesitate to use the aspirating needle. If properly introduced no harm can result. It should be of sufficient length and calibre and be introduced attached to the syringe with the piston pushed down. In this way the entrance of air is prevented. There is no place of selection for the exploration, it must be done wherever the fluid is suspected.

"If these means fail, the *x*-ray has proved of great value, particularly in the smaller encapsulated varieties of empyema. In doubtful cases, therefore, an *x*-ray should be made, preferably a stereoscopic, and if a focus is found, exploratory puncture should be done under guidance of the plate. The fact that two of our patients were sent to duty after their pneumonia and later returned for an encapsulated empyema might suggest that all pneumonia patients should be *x*-rayed before being discharged."

BECK, E. G. The Empyema Problem. (*Surg., Gyn. & Obst.*, April, 1919.)

The stereoroentgenogram and the probatory puncture are considered corroborative evidence in the early recognition of empyema. As soon as percussion and auscultation have shown that a certain portion of the chest is abnormal, stereoroentgenograms are made. The following conditions must be considered:

1. Unresolved lobar pneumonia.
2. Acute active bronchopneumonia.
3. Fluid in the pleura, serous or purulent.
4. Lung abscesses.
5. Pneumothorax.
6. Acute pulmonary tuberculosis.

He insists upon the correct interpretation of the stereoroentgenogram. His opinion is based upon the following:

1. *Unresolved Pneumonia.*—A dense shadow corresponding to any of the five lobes, with the rest of the lung comparatively normal, indicates an unresolved pneumonia. An abscess rarely produces a shadow which would correspond to the shape of a single lobe. It would produce transparent areas representing lung tissue around the abscess and possibly show a dense shadow of the abscess wall which the unresolved pneumonia does not produce.

2. *Bronchopneumonia* gives an entirely different picture. At times both lungs are involved and the picture resembles more that of an advanced tuberculosis of the lung. The entire lung (or parts of it) is studded with shadows varying in size from that of a hazelnut to that of an egg; these shadows sometimes merge into one another and leave transparent areas between them.

3. *Fluid in the Pleural Cavity.*—When the pleural cavity is entirely filled with fluid, the lung is compressed toward the hilus. If no adhesions are present it retracts upward and posteriorly. The roentgenogram of this condition will present a shadow resembling ground glass, nearly equal in density throughout the entire area occupied by the fluid. This, how-

ever, is true only when the patient is on his back while roentgenized, because the fluid gravitates and covers the entire posterior area of the pleural cavity. In cases in which the quantity of fluid is not large and the roentgenogram is made in the standing or sitting posture, we shall obtain a characteristic appearance; the fluid will gravitate into the lowest part of the pleura and produce a dense shadow up to its upper margin; above that there will be a distinct pneumothorax. Another roentgenogram made in the lateral position, namely with the patient lying on the affected side, will produce a shadow corresponding to the level of the fluid along the outer part of the chest, and a pneumothorax between the margin of the retracted lung and the level of the gravitating fluid. If the same patient is turned on the unaffected side the fluid will gravitate toward the middle line and leave a pneumothorax externally.

The roentgenogram will give us scant information as to the character of the fluid, except that the purulent fluid is likely to give a denser shadow than the serous. It requires probatory puncture to settle this question.

4. *Lung Abscess.*—The diagnosis of a lung abscess is more difficult. A patient may have had an encapsulated pocket of pus in his lung for months and even years before a diagnosis is made. Its location by physical examination is more difficult because it is usually centrally located and, as a rule, much smaller than an empyema. The tuberculous abscess has a distinct wall and is more often multiple and, therefore, much more easily diagnosed than that resulting from a pneumonia or other causes. When a patient gives a history of having suddenly spit up a quantity of pus and continues to expectorate purulent material, the presence of a lung abscess must be considered. After an abscess has ruptured into a bronchus, its localization becomes more difficult still, because the sac has collapsed, and a probatory puncture will in most instances fail to strike the pus cavity.

5. *Pneumothorax.*—There should be no difficulty in diagnosing a pneumothorax, as the physical signs are very characteristic, especially the hyperresonance. The roentgenogram, however, is most convincing. We find here the absence of shadows in a well defined area which means that the lung has retracted and the space is not occupied by fluid but by air, which of course produces no shadow whatever.

6. *Advanced Pulmonary Tuberculosis* with abscess will in the roentgenogram resemble very much a bronchopneumonia, showing areas of infiltration of different sizes, and thus the history and clinical findings must assist us in our diagnosis. The healed out tuberculous process, however, gives a characteristic picture, namely, an apparently transparent lung with fine linear markings, corresponding to the bronchi, with many small, distinctly outlined shadows of calcified deposits and many concrete shadows resembling snowflakes, which represent fine scars remaining from a healed out tuberculosis.

Action of the Roentgen Rays on the Chronic Leucemias. (*Med. Rec.*, April 12, 1919.)

There is both a quantitative and a qualitative action of the roentgen rays on the blood. The number of white cells progressively decreases in striking proportions and in one case of myeloid leucemia Beaujard noted that in seven months the number of white cells per cubic millimeter dropped from 235,000 to 5,400. This leucocytic drop continued for several days following the application of the rays. From the qualitative viewpoint, the destruction is especially evident for the myelocytes, their proportion dropping from 50 per cent to 1 or 2 per cent in a few weeks. At the same time, the number of erythrocytes rapidly increases to such an extent that in a month the increase may amount to one million. This rise in red cells is not parallel to the inverse phenomenon observed in the whites, for when the influence of the irradiations appears to have become spent on the leucocytes the rise in the number of red cells will be found to continue for some time longer.

The size of the spleen diminishes astonishingly because in a few months a spleen almost filling the abdomen may be reduced to a practically normal size. In other cases the reduction takes place more slowly. The same retrogression in the lymph-nodes likewise takes place. From ten to twenty days at the most after beginning the treatment the general health is sensibly ameliorated, the edema subsides, and the patient's appetite returns. This improvement does not necessarily coincide with a return of the blood to the normal, but

there nevertheless is a close correlation between them. The improvement in health persists as long as the number of erythrocytes is on the increase, which indicates that the roentgen rays continue their beneficial excitation of the formative organs of the red cells. The activity of this hematopoietic elaboration is the principal act; the drop in the white cells is secondary, as analyses of the blood, when compared with the variations in the patient's health, will show.

Among the mechanisms offered for explaining the action of the roentgen rays in the leucemias, it has been supposed that they destroy the "morbid elements" and toxins secreted by these elements; but even should this conception be adopted, it must be admitted that no data of positive observation can be invoked in confirmation of such a view. If the conception of a bacterial action were admitted, if the leucemia were really caused by infectious germs, how could the cure or amelioration in the health be explained? In these circumstances it must be supposed that the rays favor the process of immunization of the organism against the causal infection, but until more ample information is at hand the results of experience alone should be taken into consideration, and we know of no bactericidal action resulting from the roentgen rays applied in therapeutic doses at present employed.

It is generally conceded that the decrease in the number of leucocytes results from their progressive destruction, because after a few exposures of the rays numerous degenerated leucocytes are found in the blood, while the increase of uric acid in the urine clearly testifies to this. A number of competent writers explain this destruction by the formation of a leucotoxin or a special lysin which results either from a biochemical change in the lecithin of the white cells or from cholin, an active product resulting from the splitting up of lecithin. That such a leucolysin exists has been proven and that it is produced in normal subjects exposed to roentgen rays has been demonstrated by Ambrozio, but instead of attributing an all powerful curative action to the roentgen rays in leucemia, it would seem more logical to assign to them a single exciting action on the defensive functions of the organism by stimulating the hematopoietic organs.

This mechanism has been explained by Roch. The spleen is the center of the formation of both red and white cells and is also the center of destruction of both, therefore it possesses four centers. An untreated leucemia is the result of an exaltation of the centers of white cell formation and destruction of red cells, and roentgen ray treatment attenuates their activity and at the same time stimulates the center of red cell formation and that of white cell destruction. Why this selective action of the rays? All four centers are stimulated, but the center of white cell formation and that of red cell destruction having reached a functional paroxysm on account of the morbid process, no longer respond to the stimulating action of the rays, while the other two, previously inactive, react with all their latent energy and an equilibrium becomes established. This conception has the advantage of being derived from physiology, while it is also compatible with the theory of the leucolysins, but in this case these are regarded as products of secretion of the macrophages of the spleen which enter into hyperactivity under the influence of the roentgen rays. All these hypotheses are laudable scientific efforts, but the subject has only begun to be studied and further work must be undertaken before any definite conclusion can be arrived at.

LANE, SIR ARBUTHNOT. The Clinical Symptoms of Chronic Intestinal Stasis. (*The Practitioner*, London, March, 1919.)

RADIOGRAPHIC ASPECT OF CHRONIC INTESTINAL STASIS

The clinical aspects of chronic intestinal stasis are roughly divided into two groups depending on the preponderance and the mechanical results of stasis or the associated results of autointoxication.

The value of the roentgen examination is dealt with at some length as follows:

"In dealing with any case of chronic intestinal stasis, it is necessary, besides obtaining a clear history of all the symptoms, to get a complete report from a radiologist, who is thoroughly familiar with this class of work, on the mode of passage of a bismuth meal along the entire length of the gastro-intestinal canal, and this should be supplemented by a bismuth enema. Many radiologists are of opinion that by providing the surgeon with a number of radiograms taken at intervals of time, the latter will be able to obtain from them

sufficient information to guide him in his treatment of the case. Nothing can be more incorrect than this belief, since the screen work affords by far the most valuable information. The main points are:

"(1) The length of period that the meal remains in the *stomach*, the behavior of the stomach, the mode of emptying.

"(2) The size and shape of the *duodenum*, the mode in which it evacuates its contents, the form of the duodeno-jejunal junction.

"(3) The length of time the meal remains in the *ileum*, the mode of its evacuation, the degree of thickening of the walls of the terminal coil, the relation of the appendix to the end of the ileum, the evidence of the presence of an ileal kink.

"(4) The size and position of the *cecum*, with possible indication of its rotation.

"(5) The mode of passage of the meal through the *large intestine*, the limitation by a band of the calibre of the bowel about the junction of the cecum and ascending colon in the transverse colon, just below the gall-bladder where the acquired ligament is attached, which connects the gall-bladder to the pylorus, duodenum, transverse colon, at the splenic flexure, and at the last kink at the left pelvic brim. The form of the bowel must be examined with a view to determine the presence of inflammation of its wall or of diverticulitis.

"The shape and size of the *pelvic colon* should also be carefully observed both in the case of the meal and in that of the enema, since this is a factor of the greatest importance. The presence or absence of gall-stones should be noted.

"Besides this, the *chest* should be investigated to show the condition of the lungs, glands, heart, and large vessels.

"It is difficult to exaggerate the importance of a thorough examination, since it not only furnishes the surgeon with complete evidence as to the mode of functioning of the canal, but it also not infrequently calls his attention to defects in the tract, which he would possibly or even probably have overlooked in operating for some definite condition.

"This happens in a large number of cases, sometimes because the surgeon does not realize the utility of a bismuth meal, at other times because one end-result of stasis presents symptoms that appear so perfectly characteristic that the operator is satisfied to confine his attentions to the treatment of this condition alone, being probably unaware of its causation and regarding it as a primary disease."

The effects of an abdominal support and of paraffin are discussed, and he states that paraffin should be discontinued for ten days before the roentgen examination is made.

Bloodgood, J. C. Treatment of Tumors of the Upper Jaw with Cautery. (*Dental Cosmos*, p. 341; from *Med. Rec.*, Feb. 15, 1919, p. 299.)

The mortality has been distinctly decreased with this method, and when cures have been accomplished it has been with less mutilation. Whether the actual number of cures has been increased cannot be demonstrated at the present time. The reduction in mortality is associated with the employment of local anesthesia alone, or in combination with light chloroform general anesthesia. In many instances it is safer to remove the disease involving the upper jaw in stages. In some of Bloodgood's cases there had been as many as fourteen operations.

The new growth should be attacked with the cautery from two points. One should burn the tissue at the border of the tumor. This not only destroys the infiltrating area, but excites in the healthy tissue beyond a granulation tissue which of itself is largely protective against secondary invasion, at least during the period of complete removal. The second attack should be upon the neoplasm itself—if possible, from the center out.

Burrows, Arthur. The Therapeutics of Radium. (*Brit. Med. Jour.*, March 15, 1919.)

The report of Dr. Arthur Burrows, radiologist to the Manchester and District Radium Institute, for 1918, describes the work done during that year and contains also a summary of the lessons that have been learnt and the results obtained during four years. The number of persons applying for treatment has increased and reached 648 in 1918. In 48 cases of malignant disease the patient was rendered free from symptoms and signs during the course of the year, and 18 out of 33 cases of rodent ulcer treated to a termination were cured. In the

summary of the four years it is stated that practically all early rodent ulcers can be cured by radium alone. To date, 31 cases have been well for two years or more, and of a number of other patients who have not reported it is believed that many are still well. With regard to the treatment of malignant disease, it is observed that at present only inoperable cases are treated by radium. In its use various factors have to be considered: extremely rapidly growing tumors, like melanotic sarcomata, cannot be expected to yield good results; it is also found that carcinoma of the tongue does not usually respond favorably to radium. Extremely large growths are apt to slough and ulcerate, and the tendency to resolution is small. Growths involving bone cannot as a rule be satisfactorily treated, but a case of periosteal sarcoma is illustrated, which remained well for twelve months and then died of another disease. Tumors which retain some mobility, have a good blood supply, and are surrounded by healthy tissues, generally respond best to radium treatment. So far, it has not been satisfactorily demonstrated that the histological nature of the tumor, with a few exceptions, has much bearing on the immediate result of radium treatment. The best results from radium treatment have been obtained in carcinoma of the cervix of the uterus. "These cases are always treated by burying five to seven platinum tubes, the walls of which are three-tenths of a millimetre thick, containing altogether not less than 120 millicuries of radium emanation. The tubes are maintained in position for twenty-four hours by gauze packing. The quantity of emanation used must vary somewhat with the size of the tumor, but it is found that the best results are not obtained if not less than 120 millicuries are used. This heavy dosage is, of course, somewhat of a drain on the resources of any radium institute." From a numerical list of the cases of malignant diseases of all varieties treated at the Institute it appears that thirty such cases previously deemed inoperable have been well for a period of two years or more. Radium has a very remarkable and rapid effect on certain local tumors. Lymphosarcoma disappears rapidly, but fresh tumors usually continue to arise in distant lymphatic glands. Glioma or gliosarcoma of the orbit disappears within a fortnight, but returns. Good results are obtained in some sarcomata, notably inoperable sarcoma of the superior maxilla. The local lesions of Paget's disease of the breasts, as a rule, clear up, but as the formation of secondary deposits in the breast and glands is to be expected, a radical operation should be advised. Individual secondary carcinomatous glands, if not too large, rapidly disappear if treated by burying radium tubes in their substance, but infection of glands at a distance commonly ensues. Another point made is that radium treatment may render operation possible, in carcinoma of the breast, of the bladder, of the cervix of the uterus, and for the removal of sarcomatous masses. Apart from all this, radium is of great use in relieving the discomfort of patients suffering from hopeless cancer. It is employed to relieve pain, heal ulceration, check discharges, stop bleeding, and thus to improve the general health of the patient. An appeal is made to the supporters of the Manchester Radium Institute to provide more suitable premises, and special beds for the treatment of cases in which it is thought desirable to bury tubes of radium emanation in the growths. Well lighted, well ventilated premises are very essential for the welfare of the radiologists and the nurses.

St. John, A. Crystal Structure of Ice. (*Nat. Acad. Sci., Proc.*, 4, pp. 193–197, July, 1918; from *General Physics*, Vol. XXI, p. 405.)

An account of a careful x-ray analysis of the structure of ice. Special precautions were taken to keep the ice in a perfectly dry condition and to prevent sublimation. When protected in the manner described specimens of ice crystals were preserved for days. Commercial artificial ice was first examined as it shows a marked prismatic structure. Unfortunately the prisms are distorted through pressure in the formation of the ice, so that it is difficult to identify cleavage planes. Measurements on carefully prepared ice crystals, however, show that ice is properly assigned to the hexagonal system; that it contains four interpenetrating triangular lattices, and that the fundamental spacings are: $a = 4{\cdot}74 \times 10^{-8}$ cm.; $h = 6{\cdot}65 \times 10^{-8}$ cm.; $d_{1120} = 3{\cdot}79 \times 10^{-8}$ cm.; $d_{1010} = 2{\cdot}37 \times 10^{-8}$ cm.; $d_{0001} = 3{\cdot}32 \times 10^{-8}$ cm.

"PROTACTINIUM," A NEW RADIO-ACTIVE ELEMENT

According to a note in the *Chemical Trade Journal* for June 29th, a new radio-active element of considerable emissive power has been detected in the residue from pitchblende, which forms the raw material employed as a source of radium. This residue was subjected to treatment which finally left undissolved only the members of the tantalum group; and this insoluble remainder showed a radiation, at first slight, but gradually increasing largely, which proceeded mainly from the evolution of actinium, and indicated the presence of the new element "protactinium." Experiments for the separation of the elements are to be undertaken. The period of semi-disintegration probably fluctuates between 1,200 and 18,000 years. The information is based on statements published in the *Münchner Neueste Nachrichten.—Nature.*

Radiology of Tuberculosis Suspects. (*Paris méd.*, Vol. 9, No. 5, Feb. 1, 1919; from *Jour. Am. Med. Assn.*, Vol. LXXII, No. 14.)

Delherm relates that among the 1,100 men suspected of tuberculosis and sent to his *centre de triage* for confirmation, 694 proved to be exempt from tuberculosis. Others have reported that 50 per cent of the suspects proved to be nontuberculous. Roentgen examination often turned the scale, the radiograms taken not only of the whole lung but of the suspicious points. Especially important is stereoscopy taken erect, in the course of the same apnea. When the apex looks suspicious, he leaves it and examines other parts of the lung, having the patient cough and breathe deep. Then when he returns to the apex he often finds that it has cleared up. Some people never aerate the apex fully. When the bronchi cast wide, pronounced shadows, usually bilateral, the presumption is in favor of ordinary bronchitis; with tuberculosis, with such findings there would be other signs of it in the lungs. With cancer of the lung, the subjacent lobe is clear, and the outline of echinococcus cysts is usually roundish and well defined. He has encountered one case of syphilis of the lung; the signs of infiltration under the right clavicle and positive physical findings were not accompanied by bacilli in the sputum, and rapid improvement followed specific treatment. After pleurisy, the base may look veiled, owing to symphysis, and the movements of the diaphragm may be hampered by adhesions, and the lung look gray in parts. The clearing up of the lung during respiration and coughing and the absence of foci of congestion in the subclavicular region are instructive. In other cases, however, nothing but the continued absence of tubercle bacilli from the sputum will finally exclude tuberculosis.

Radiotherapeutic Treatment of Local Hyperhidrosis with Hand Rays. (*Berliner klin. Woch.*, Dec. 30, 1918, from *Med. Rec.*, March 8, 1919.)

F. M. Meyer, after six years' work along these lines, believes that only hard radiations, greatly filtered, can surely cure hyperhidrosis. The dose of rays employed must vary with each case and it is well to proceed by repeated séances, each one of which should be made at a different area of the cutaneous surface under treatment. A cure requires considerable time, since destruction of the sudoriparous glands must be obtained. As to complications, an alopecia frequently results in the axilla and, besides, the skin offers a certain hardness with a tendency to fissuring. However, these untoward results are readily accepted by patients for the good results otherwise obtained.

YOUNG, E. L. Clinical Diagnosis of Lithiasis of the Upper Urinary Tract. (*Jour. Am. Med. Assn.*, Vol. LXIX, No. 18.)

No single piece of evidence, or combination of evidence, is sufficient to make an absolute diagnosis of a renal or ureteral stone. All chance of mistake should be excluded by using ureter catheters, wax-tipped catheters, stereoscopic plates, and roentgenograms with injected pelvis.

In all cases with indefinite symptoms, such as recurrent or chronic pain in the abdomen or back, even when a definite orthopedic abnormality is present, careful, repeated examination of the urine should be made, including a microscopic examination of centrifuged sediment, regardless of the presence or absence of albumin. In the female, such examination

is of value only when the urine is obtained by catheter. Whenever operation is considered in any one of this group of cases, roentgenoscopy in addition to the foregoing examination is necessary.

BUGBEE, H. G. Clinical Study of Lithiasis. (*Jour. Am. Med. Assn.*, Vol. LXIX, No. 18.)

Intestinal stasis is an important predisposing factor in the formation of urinary calculi. Urinary stasis and infection are immediate predisposing factors. Renal mobility plays an important rôle in this consideration.

Renal calculi may be single or multiple; small or large; unilateral or bilateral; located in the cortex, the pelvis or a calyx; or they may be branching, completely filling the cavity of the kidney.

Local symptoms may be absent, slight, or acute. Physical signs may be absent or definite. A diagnosis of the presence of a calculus should be made by cystoscopic and roentgenographic methods. Contact of the tip of a roentgen-ray bougie will verify the diagnosis in many cases of renal calculi, but may have to be supplemented by pyelograms, not only to locate exactly the stone in the kidney, but also to show the extent of kidney destruction. Data so obtained make it possible to outline the operative procedure which will result in a cure, and after-care may prevent recurrences.

Ureteral calculi are common. They may give rise to indefinite abdominal symptoms, or to typical colic. Fifty per cent of ureteral stones will pass; 75 per cent will be passed following intra-ureteral manipulation, which consists in dislodging the calculus and dilating the ureter below.

Vesical calculi are comparatively rare, owing to earlier diagnosis and the better treatment of vesical obstructions. When found, they are smaller than formerly, owing to the earlier diagnosis, and can often be removed by litholapaxy, unless a prostatectomy is necessary.

Prostatic calculi should be suspected in long-continued prostatic suppuration. They should be diagnosed early and removed by prostatectomy.

BOOK REVIEWS

BERNSTEIN, RALPH, M.D. Ultra Violet Rays in Modern Dermatology.

In a small monogram of 162 pages the author presents the essential features of the history, the physiological effects, a detailed description of the Kromayer and Alpine lamp, and the therapeutic application of the ultra violet radiations in the treatment of affections of the skin.

The historical data and physiological effects of the ultra violet radiations are very briefly considered by the author, while a most liberal space is allotted to the description of the Kromayer and Alpine lamp.

The author's technique is based wholly upon the applications of this particular type of apparatus, which he evidently considers the only mechanical device suitable for this class of work.

Those who are using it may find the technique described by the author of this book of considerable value.

JOHN H. BURCH.